DOCUMENT RESUME

ED 209 065 SE 029 675

TITLE	Program Evaluation: Project City Science. Final Report.
INSTITUTION	City Univ. of New York, Flushing, N.Y. Queens Coll.
SPONS AGENCY	National Science Foundation, Washington, D.C.
PUB DATE	31 Aug 79
CONTRACT	NSF-SER-77-26936
NOTE	177p.; For related documents, see SE 029 674-676. Not available in paper copy due to marginal legibility of original document.
EDRS PRICE	MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	Curriculum Development; Educational Assessment; *Educational Research; Elementary Secondary Education; Inservice Teacher Education; *Junior High Schools; *Program Evaluation; Science Curriculum; *Science Education; Science Projects; Science Teachers; Secondary Education; *Secondary School Science; Summative Evaluation; *Teacher Improvement; Teacher Interns
IDENTIFIERS	Project City Science

ABSTRACT

Presented is the final evaluation report of the Project City Science (PCS). The PCS, a program conducted by New York University and funded by NSF, sets as its major goal the improvement of junior high school science instruction in the inner-city environment. This report consists of eight sections. The first section, which presents an overview of the project, covers funding and project intent and evaluation procedures. The second section, which reports the operation of the project, covers staffing and organization, modifications, and support for implementation. The third section deals with the assessment of funding implications, instructional methodology, university/school relationships, and effective change. The fourth section presents general conclusions. The last four sections are concerned with the four major aspects of the project which are the preservice program, model districts program, dissemination program, and research program. (HM)

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PROGRAM EVALUATION:

PROJECT CITY SCIENCE

FINAL REPORT

ED209065

SUBMITTED TO THE
NATIONAL SCIENCE FOUNDATION
BY QUEENS COLLEGE

AUGUST 31, 1979

SE 029 675

FINAL EVALUATION REPORT

PROJECT CITY SCIENCE

1979

Report submitted by
Queens College to the
National Science Foundation
August 31, 1979

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The material in this report is based upon work supported by the National Science Foundation under Contract No. SER 77-26936. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the author and do not necessarily reflect the views of the National Science Foundation.

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ACKNOWLEDGEMENTS

The evaluation team would like to extend its sincere appreciation to the Project City Science staff. Their cooperation throughout the course of the evaluation has been extremely helpful. Under adverse conditions, and a heavy teaching schedule, the staff remained personable and responsive to the needs of the evaluators. Throughout the course of the evaluation, they suffered our presence with considerable patience and grace, retaining their candor and a balanced perspective even when what the evaluators had to say was not completely favorable. The staff was thoroughly cooperative and we are thankful for the courtesy that they extended to us.

We would also like to thank the Project Director, Dr. Fletcher Watson, whose competence and insight impressed us. His grasp or operational aspects of the Project was excellent, and his understanding of the Project staff's capabilities was quite detailed. He lent a measure of leadership and administrative ability which was extremely helpful to the Project during a difficult time. As evaluators, we appreciated his presence and the quality of his efforts on behalf of the Project.

We could not close without mentioning the contribution of the Associate Project Director, Dr. James Connor, whose willingness to give of his time seemed of immeasurable importance to the Project. Due to changes in leadership, his role at key junctures was critical, and his contribution throughout was significant. Much was asked of him, and he responded well. His efforts were respected by both the Project and evaluation staffs.

As was the case with the Project leadership, we found the rest of the staff to be congenial, able, and consistantly courteous. We are most thankful for the way they received us. The major regret the evaluators had was the feeling that we may have been less helpful to Project staff in specific, individual ways than we could have been. Perhaps that was a fault in our definition of the role. Dr. Watson has offered a recommendation that is not unreasonable and which we feel merits serious consideration by future evaluative groups:

> I wish to make a suggestion which could reduce the communication gap between those inside and those outside. Why not station a member of the external evaluation team as a continual observer within the Project? Then there would be continuous feedback of information, and perhaps greater clarity of reporting on the actual operation of a project such as this. Such an agent on the scene could also raise in advance questions of interest to the external evaluators.

The evaluation team would also like to acknowledge a debt of gratitude to our advisory panel, without whose help and encouragement a difficult task would have become more than burdensome. The NSF, in its wisdom, suggested the formation of such a panel. Its members, Drs. J. Myron Atkin, Jerome Notkin, and Vincent Reed, have been exceptionally helpful, and we would strongly recommend the use of such a panel to other evaluators embarking upon a similar venture.

Last, we would like to thank the National Science Foundation for the freedom it offered us in pursuing the evaluation, and in reporting the events as we saw them.

I. OVERVIEW OF THE PROJECT

A. Funding Intent

During the early part of this decade, the policy of the National Science Foundation (NSF) had been expanding from an earlier emphasis on the development of teaching talent * to include attempts to support large scale efforts aimed at influencing broad educational networks. This latter evolution can be traced in the Foundation's development of support for Comprehensive Programs, and, later, the Systems Awards, both of which stressed concern with issues that were more intricately interwoven within the deeper structures of education. The problems addressed were broader and solutions were aimed at the level of fully developed systems rather than at discreet individuals working within them.

The Foundation was also re-examining at this time the issues of impact and residue, i.e., how the projects supported were influencing the education of students, and which influences remained operative when funding was withdrawn. The re-examination led to the support of long-term efforts in which the Foundation committed itself to multiple year funding. Such an approach allowed recipients to design programs that were longitudinal in nature, and whose assessment could contribute in important ways to our knowledge of particular aspects of the educational effort. This approach represented a significant departure from the earlier practice of supporting non-product oriented interventions on a short term basis, which had been the predominant mode.

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* An emphasis which manifested itself mainly in the form of summer and academic year institutes that provided training for in-service teachers.

In assessing these more broadly conceived, long-term proposals, support was given to projects that focused on a specific need or problem within the larger educational system, and which offered a design for coordinating the efforts of relevent agencies and institutions concerned with the identified problem. In pursuing this policy, the Foundation was seeking to allow the directors of such projects a greater amount of discretion and flexibility. It was further hoped that these long term commitments would result in decisions by local funding agencies to offer financial backing for project functions whose usefulness had been demonstrated during the time that NSF had supported them.

Project City Science (PCS) represented one such effort.* PCS appeared to be an important, and in many ways necessary venture on the part of NSF, to support a broadly conceived innovative educational venture in an urban environment. The concept was, for a number of reasons, an idea whose time had come. The nation was increasingly concerned with the social consequences of urban decay and dislocation. The writers of the original proposal put forward a sound analysis of the plight of the schools in the inner cities of the nation. The compelling need to learn more about the environments in which increasing numbers of our young people were being educated was clearly and skillfully developed. The Project had the focus that the Foundation was seeking and offered a means of coordinating the efforts of a number of agencies concerned with the problem.

Beyond specifying a particular environment (the inner city), the proposers of the Project went on to identify a specific level (the junior high school) and function (science) within the educational structure that clearly required greater attention than they had theretofore been given.

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*The Project was proposed and conducted by members of the Department of Science Education at New York University.

The junior high school has long been an anomaly within the public school structure. Despite its problematic status, all too little attention has been paid to the unique set of problems faced by educators at that level. The developers of PCS addressed these concerns with skill and imagination. They presented a perspective that provided a broad view of the problem, and recognized the need to specially train pre-service teachers for this environment. The proposal indicated an intent to offer additional aid to those currently in service, and to develop a school-university support system that would make available the best that each institution had to offer. It was a well conceived design, ambitious in scope, although perhaps overly optimistic in its stated and implied expectations. The design clearly encompassed major problems faced by educators at junior high school level, and offered the promise of dealing with them through a coordinated, inter-institutional effort, comprising research, teacher training, and implementation of innovative ideas.

Project City Science became one of several large scale, long term programs supported by NSF. In supporting such projects the Foundation appears to have had several sets of expectations - some more explicit than others. First, of course, was the hope of fulfilling the particular purposes for which each project had been designed. Second, and perhaps of lesser concern to the internal project management, was the Foundation's hope that the programs supported might not only accomplish their purposes, but do so in objectively measurable ways. A further hope was that a residual effect of such aid would be the willingness of local funding sources to assume the support of certain worthwhile project functions.

To aid in accomplishing these purposes, each of the projects, including PCS, was provided with an internal evaluation capability. In the case of Project City Science, an external evaluation mechanism was also provided.* The ultimate purpose of the evaluation was to provide an outside perspective on what the Project had accomplished. This included an assessment of its outcomes during the funded phase, and an estimate of its continuing influence and prospects for the future. As stated in the Foundation's original charge to the evaluators:

> (The) third party evaluation is requested to provide a summative look at the funded period of the project from an external perspective. The evaluation should include a portrayal of the project indicating its strengths and weaknesses as determined by both the examination of existing data and the collection of new data. In addition, the study should provide insight on possible future directions for the project during the remaining ten years and aid NSF in making future policy decisions regarding projects of this type.[1]

B. Project Intent

As noted earlier, the submission of the PCS proposal coincided with, and was responsive to,

> a stated NSF interest (in) experiment(ing) with more flexible, more sharply focused and more fully coordinated approaches to staff development and support activities than was possible in other NSF programs, such as teacher institutes.[2]

The PCS proposal was based on a conscious decision by the leadership in the science education department at NYU to identify an area of need that was large enough to require their attention, and yet small enough to respond

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* The PCS staff has noted that a fuller external evaluation was not provided until the fourth year of the Project's existence, which in their view was rather late to be of sufficient help.

to efforts at improvements. It was decided that science at the junior high school level met these conditions. That it was an important area of need, few would dispute. The NYU staff also felt that as a project focus, it represented a problem of manageable proportions - one that was in their opinion sufficiently well defined to admit of possible solutions. That view was most clearly expressed by the project staff in its response to an evaluation of Phase I, that is the first two years of the PCS effort:

> We do not regard the gigantic City as our object of interest. We are interested in only a small but very important part of the City, namely the teachers and students in the intermediate science classrooms, and we do not regard these teachers and students as resistant foes to be overcome. The teachers are individuals who can change and become more effective <u>if</u> they are given help in clarifying goals, and provided with new insights concerning their students and their situations.[3]

As is clear from the response cited above, the Project staff had a reasonably clear picture of its major intent. It was one of revitalizing science teaching within the junior high schools of New York City. In the process, the staff hoped to discover and document some things that would be useful to educators in other urban areas. The immediate purpose was to develop two model districts within the New York City system that would reflect "the highest possible level of intermediate science teaching."[4] A more long range intent was to gradually fill a significant portion of the city's junior high school science teaching positions with PCS graduates, who had been specially trained to work in the urban environment. Indeed, the Project leadership entertained the hope that:

> If Project City Science succeeds, and if it is duplicated in other cities, in ten years we could replace up to 40 percent (of junior high science staffs) with a cadre of science teachers trained for the job.[5]

In brief, these two statements epitomize the nature of the long and short range purposes to which the Project had committed itself. The Project staff believed that the junior high occupied a position of unique importance in shaping students decisions to continue their education in science, since most of the courses offered in the high school are elective, rather than mandatory.

In working toward the accomplishment of the goals described above, the staff anticipated the achievement of four definite objectives:

1. The development of the two model school districts.
2. A unique pre-service training program at NYU.
3. A research and evaluation institute.
4. A strategy model for institutionalizing change.*

In explaining what PCS was attempting to accomplish, it is important to point out the difficulties the Project faced as it prepared to implement its design. The staff had already chosen perhaps the most difficult educational environment to work in - that of the inner city. The difficulty was further compounded by the fact that the Project was conducted in the most populous, and perhaps the most varied and complex, of the nation's cities. Beyond this, the staff had decided to work at a level within the school system, which while surely in need to aid, has been an enigma to many educators; the education of adolescents is still the most demanding and

*This later evolved into, or was replaced by, a program of dissemination.

challenging task facing the schools. While acceptance of that challenge gave the Project added importance, it also posed a serious test of the skills and resourcefulness of the staff selected to implement the objectives. The vision and foresight of those who would hire the staff were to be put to the test, for the scope of the task assumed was audacious.

Within this complex geographical setting and demanding instructional level, two school districts were selected that themselves offered numerous challenges. Whether by design or through oversight, few concessions were made to the mounting list of difficulties with which the Project would have to deal. The apparent intent was to face, as completely as possible, the full set of burdens encountered by teachers working in this environment.

During the second year of its existence, the Project was faced with a fiscal crisis in New York City that threatened to destroy much of what had previously been accomplished, and which thoroughly upset all plans for the future. There were massive lay-offs of instructional staff, indiscriminate reduction of support services, and wholesale reassignment of teachers with seniority to positions for which they were neither licensed nor trained. The Project staff, which had earlier attracted a number of younger innovative teachers to participate in their activities, suddenly found that most of those with whom they had been working were no longer employed. Compounding the problem was the fact that many of those who replaced them had little experience and even less training in teaching science. Much of what had been initiated needed to be reinstituted and most of what had been planned, redesigned. It must be understood that the

Project faced more than a simple change in personnel in the schools. The entire climate was altered. Teacher morale had been dealt a serious blow, and the PCS staff was working in an environment which was far less hospitable to the concept of school staff committing extra time and effort to the improvement of teaching. Even where attitudes remained more wholesome, energies were consumed by the more compelling demands of maintaining a badly shaken system of education. Few in such a climate were prepared to turn their attention to the implementation of innovative instructional techniques.

Finally, to the problems facing New York City, must be added the economic difficulties which New York University itself was undergoing. The Project, designed during a growth period, was actually funded during a time when the University was experiencing some fiscal problems of its own. The result was a reduction of the total staff, thereby placing great restrictions upon the availability of supporting services. PCS, predicated upon a university wide support system, now found it more difficult to marshal the type of help once hoped for. The problem was exacerbated by the fact that the Department of Science Education was also experiencing shrinking enrollments. The crisis in New York City made the prospect of obtaining a teaching position appear poor,* and so student applications fell accordingly. Mounting economic restrictions seemed to settle upon the Project from every direction.

It is difficult for evaluators to render a judgment as to how damaging such a series of crises were to a fledgling project struggling to establish itself.

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*That this was never completely true for positions in science and mathematics, was not clearly understood by many teaching candidates, although it was to become more readily apparent with each passing year.

It certainly seems reasonable to assume that they represented a serious blow to the enthusiasm and hopes of the staff. Providing leadership during such a time is difficult. The maintenance of the Project vision and of staff morale must have been particularly hard. There was considerable staff turnover during the early years of the Project. Some of this was planned, but not all. The loss of so many staff members, and particularly those who were mission-oriented, could well have taken the edge off their efforts. What is clear is that Project City Science was faced with a difficult set of additional burdens early in its history. The extent to which that inhibited Project achievement will never fully be known.

What has been described above is not offered as an apologia for the Project. The evaluators do not seek to imply that one is needed, nor would we attempt it. While there were problems, there were rich opportunities as well. What we have tried to do is to describe objectively, and in fairness to the PCS staff, the historical circumstances in which the Project found itself as it attempted to implement its design. We note that these events took place prior to the evaluation period for which we are specifically responsible.* A number of the circumstances described were far less pressing during the time of the current evaluation, but we would not interpret our charge so narrowly as to preclude the possibility of their exerting a continuing influence. In pointing to them, we hope to provide a backdrop against which the Project's continuing activity might be examined and better understood. Where the constraint upon achievement is attributable to the general environment, it should be noted, as must be the failure of the Project staff to fully seize or

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* This evaluation covers the second phase of the Project's operation, 1976-79.

capitalize upon the opportunities that their unique position afforded them.

C. Summary of Original Proposal

1. Funding

Project City Science was initially funded by NSF for a 34 month period, beginning in May, 1974, and terminating on March 31, 1977, though a subsequent proposal indicated that:

> the intention was for most of the funds to be expended over a two year span ending August 31, 1976. The grant was made to underwrite the initial phase of what hopefully would become a three-phase, fifteen-year plan to greatly improve science teaching and learning in the large cities of America.[6]

In accordance with this plan, a second proposal was submitted by N.Y.U. requesting and receiving funding for an additional three years of operation that would constitute the second phase of the original design. Such funds were to insure continuation of the project from September of 1976 through the summer of 1979. Thus, the entire duration of outside funding was to extend over a total of five years, though there appeared to be some overlap in the funding provided for Phase I (1974-77) and Phase II (1976-79).

Phase III of Project City Science was expected to continue for another ten years beyond this initial five year funding period. The last phase was to be entirely self-supporting.[7] The PCS staff would use the funds initially provided to create the structure upon which the continuing operation of the program would be built. The intent was to make the PCS model a part of the permanent structure of New York University as well as to develop a strong base of support in the New York City schools and surrounding colleges and universities.

The proposal* noted that at the end of these years of funding, project functions and activities will be self-sustaining.

2. Project Intent

Project City Science represents an attempt to examine and deal with the problems of education in the urban setting. The proposal notes that while nearly seven out of every ten school children in the United States reside in metropolitan areas, the schools they attend too often reflect the limitations of the urban environment: Persistent overcrowding, a rapid flux of ethnic population, a steadily increasing proportion of the very poor to be served, deteriorating physical facilities, and a shrinking financial base.[8] In the view of the proposal writers, one consequence of these limitations is that the quality of education in American cities has declined sharply and there is an urgent need to develop means of addressing the problems that have resulted.

PCS was designed to deal specifically with one dimension of that problem. The proposal states the major intent of the project as follows:

> 1) to put together a cooperative effort in New York City involving teachers in the city schools, the teachers' union, administrators at school, district, city and state levels, community organizations, professional associations, and several universities within the city, a coalition that can bring about over a fifteen year period a dramatic improvement in the teaching and learning of science in the intermediate schools (grades 6 through 9);
>
> 2) to do this in such a way that the reform process becomes continuous and institutionalized; and
>
> 3) at the same time, to generate and disseminate knowledge about adolescents, the learning of science in the inner city situation, and the process of improving science instruction.[9]

*Unless otherwise specified, the proposal referred to will be the full proposal dated 12/1/75, which was initially submitted requesting funding for Phase II of the Project.

In a later section of the proposal, what is referred to as the central purpose of the project is restated from the original (1974) proposal:

> to help bring about a major, lasting and self-perpetuating improvement, principally in New York City, in the teaching of science in the middle grades between elementary and high school.[10]

While the rationale for placing primary emphasis on science rather than on other subjects, such as reading or mathematics, is not clearly stated, it is evident that the proposers of PCS feel that science is an area in which instruction in particularly ineffective. It is noted that:

> science teaching at the middle school level in New York City and many other cities can only be regarded, on the whole, as gravely inadequate... (Further), science education in the city elementary schools remains woefully weak, when not absent altogether.[11]

Having concluded that, "improving elementary school science in the cities seems to be an intractable problem of massive proportions."[12] Project staff apparently decided that the middle school (i.e. grades 6-9) should become the logical focus of their efforts. The reasons offered for this appear to be three-fold. First, a large fraction of inner city youth do not go on to attend high school, and so efforts made at a later stage would be too late. Second, by the time students reach high school, a deep antipathy toward the study of science has already developed, and so they will usually not choose to take courses in science; and, third, even though many educators agree the junior high school years may be critical for students, very little emphasis has been placed on developing procedures that improve instruction or modernize curriculum at this level - particularly in science.

The proposal goes on to clearly emphasize its junior high school focus.

> For many city youngsters, junior high school provides the only formal instruction in science they receive in their lives!...it constitutes quantatively the most science they will formally encounter.[13]

Project emphasis was not solely upon the direct improvement of science instruction in the school, but upon the development of a model program for training junior high school science teachers as well. The intent was to both provide science teachers for the New York City middle schools, and to develop a training model with widespread potential. The then Project Director, interviewed for an article about PCS, indicated what the program's major concerns were:

> First, we're doing inservice training of teachers who are already in the schools. Second, we're designing a training program for the whole next generation of junior high school teachers. Third, we're working to analyze instructional problems and devise system-wide solutions. ... Over the long run, (the Director) can envision Project City Science helping to effect a new kind of science teaching... If Project City Science succeeds, and if it is duplicated in other cities, in ten years we could replace up to 40 percent with a cadre of science teachers trained for the job... What we want to develop is a design that can be used in city schools throughout the country, something that can be adopted quickly by other universities and other school districts.[14]

3. Project Goals

Since the funding provided for Phase II of the project was substantially less than that originally requested, a revised proposal was submitted to NSF by New York University restating what was to be accomplished. The goals of the project had changed very little, though the revised proposal notes that:

> At the level of funding (provided)...it will not be possible to accomplish (them) as rapidly as originally proposed or with the same probability of success.[15]

Nonetheless, the proposal clearly states that:

> The main purpose of Project City Science remains unchanged: to improve intermediate and junior high school teaching in New York City and to learn something in the process that will be useful to colleagues in other urban areas... (Program cutbacks would be) undertaken using three criteria:
>
> 1) the project's chief characteristics must be preserved. These include utilizing a cooperative and functionally comprehensive approach, keeping the school district as the chief unit of attention, being knowledge-generating and making and keeping long-term commitments. These features were to be regarded as more crucial than extensiveness and magnitude.
>
> 2) Those activities most likely to lend themselves to institutionalization should be favored. To insure continuing reform, this must be sought in the university, school, and community setting.
>
> 3) Whatever is to be undertaken must contribute to the development of a concrete, describable, visible entity or product that has dissemination capabilities.[16]

While the Phase I aspect of the project that was initially funded dealt with 16 separate areas, the revised proposal submitted for Phase II functionally reduced these to four areas in which a major effort would be concentrated:

> At the level of funding now available, the project will work toward the achievement of four definite products. These are: 1) two model districts; 2) a unique pre-service program; 3) a research and evaluation institute; 4) a strategy model for change and institutionalization.[17]

The development of these four "products," then, is set forth as the major goal of the current phase of the program with which this evaluation is concerned. The report will attempt to clarify the anticipated outcomes of each of the four major aspects of the PCS program and comment on the effectiveness

of the effort the project staff has mounted to attain them.* In analyzing these efforts, it is useful to keep in mind the major problems that the proposers of Project City Science felt PCS was created to address:

> Assuming, then, that there is an especially urgent need to improve science instruction during the transition years, what are the particular problems that must be solved or at least ameliorated? The 1974 proposal explicitly claimed, and Project experience has subsequently supported, that three major problems exist:
>
> (1) The failure of teacher training, both preservice, and inservice, to prepare science teachers to deal effectively with the early adolescent child in the inner-city situation.
>
> (2) A continuing reliance on science programs that do not reflect sufficiently what has been learned in the last decade or so about science curricula and new approaches to teaching science.
>
> (3) A scarcity of systematic knowledge about the age group and about what conditions and techniques best promote an interest in a learning of science at that age and in inner-city circumstances.
>
> Implicit in the proposal and accentuated by Project experience is a fourth problem: The failure on all sides to identify, organize, and bring to bear in a coordinated way the not inconsiderable material and human resources of the state, city, district schools, universities, and community at large. Related to this is the problem of establishing a self-sustaining system for continuing reform rather than merely instituting this or that improvement, regardless of how alluring a given reform seems to be in the short run, or however much desired by one or the other agency or institution.[18]

As clearly demonstrated by the text cited above, the four components of the project were created as a means of responding to the problem areas defined. Those problems center around the need for improved teacher

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* For a clear and brief definition of the goals of each of these four areas of the program, the reader is referred to Appendix O, which is taken from the revised proposal submitted by New York University to the National Science Foundation.

training, better instructional practices, a more informed research effort, and an improvement in the way resources are brought to bear on difficulties that have been defined.

As will be evident throughout, the evaluators feel the most equitable practice in stating project objectives and clarifying intent, is to allow the documentation to speak for itself. Summarizing the overall purpose of Project City Science, the following excerpt from Progress Report #11 seems to offer the most concise explanation of both the immediate and long term purposes of the program:

> As stated in the Project City Science revised proposal for refunding, the Project is committed to the establishment of four products: two model districts, a unique Preservice Program, a research institute for the study of inner-city science, and a well-articulated model for change and institutionalization. Furthermore, activities undertaken which fall under each of these rubrics would be ones which lend themselves to visible entities with dissemination capabilities. Clearly, from its inception the Project has had a wide scope in mind, with the hope of having its model for educational reform adopted by other major universities and their neighboring school systems throughout the nation. Indeed, this notion is contained in the phrase, mission-oriented Project. To accomplish broad goal calls for communication with university researchers and administrators and the administrative and teaching personnel of school systems.[19]

The proposers of the Project as can be seen from the language of the above quotation, set very important goals for the program. The Project had high expectations for what it could accomplish in its immediate environment - the schools of New York City. Beyond that, the hope was to establish models and assemble data that would be of interest and use to the broader community of science educators.

As noted earlier, the PCS Project Director believed that the program could help "effect a new kind of science teaching." Each of the four major components of the program was intended to meet not only local, but broad, long-term goals. A CBTE document filed with the State of New York described the preservice program as follows:

> The preservice Intermediate School Teaching Program is taking form, acquiring character and before long should have established itself nationally as the highest quality program of its kind.[20]

Similarly high expectations were held for each of the remaining major components of the program:

Dissemination:

> We're disseminating what we learn. Eventually we'll have a national network of city school systems that have access to what we've developed and we'll have documentation for them to go to.[21]

Model Districts:

> We propose to have within three years two school districts operating in such a way as to stand as visible, visitable examples of what can be attained even in the face of inner city economic and political problems.[22]

Research:

> A comprehensive research program to analyze instructional problems and offer broad solutions (is part of the program). The intent is to design a lasting mechanism that will begin to make headway in generating systematic knowledge about the science learning of early adolescents in the

> inner city situation and also about how to achieve science teaching in the inner city schools.[23]

The task the Project sought to undertake was a serious and difficult one. The goals set were broad in scope and often quite complex in dimension.* Even following two years of experience and facing a reduced budget, the Project leadership appeared to feel the accomplishment of the major goals originally set for PCS remained within reach.

D. Evaluation Plan and Procedures

The assessment of Project City Science addressed itself to the major priority of the program, the effort to improve science instruction in the urban intermediate school environment. The evaluation followed a "responsive" approach pioneered by Stake and others at the University of Illinois. In a responsive evaluation, considerable emphasis is placed upon close observation of the program being conducted and continuous interaction with project staff and others participating in its functions or served by them. Primary attention is given to the activities and communications of the project, identification of major issues related to these activities, and the collection of relevant data upon which judgments can be based.[24]

To accomplish these purposes, the evaluators employed a design composed of four basic elements: A program of regularly planned observations, a series of interviews conducted with key participants, the collection of

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* Appendix P offers the full set of Project goals and a list of attendent activities related to these goals, drawn from the proposal submitted by PCS to implement Phase II.

questionnaire and survey data, and a thorough review of Project documentation. Once the design had been developed, an advisory panel was formed to offer the evaluation team an outside perspective. The advisory panel consisted of Drs. J. Myron Atkin, Jerome Notkin and Vincent Reed. They provided the evaluators with expertise in the areas of program assessment, science education, and school administration. Members of the panel visited PCS field-sites, observed and interacted with Project staff at NYU, and consulted with the evaluation team at regular intervals.

The program of planned observations constituted an element of major importance in the conduct of the evaluation. It included regular visits to classes conducted for pre-service interns at the University, monitoring PCS staff meetings and attending meetings of smaller groups of Project staff. Evaluation team members were also in attendance at several conferences where Project personnel discussed activities or presented papers. Observations were also conducted at all Project field sites on a regular basis. Observation visits were not confined to members of the evaluation team. A balanced set of visits by science educators working at the college level, science supervisors from the public schools, and classroom science teachers was also arranged. Observation protocols containing evaluative comments or written reports were requested of all observers.* Observations were conducted throughout the course of the evaluation and observers were sent to both University and public school classrooms. Some videotaping of instruction in the schools was also conducted.

*Appendices F-H represent a summary of these reports.

An equally extensive effort was made to continuously interview those connected with the Project. Interviews were conducted with all Project staff, interns and school personnel over a two year period. Both structured and informal interview procedures were employed. A number of interviews were taped to allow a more accurate and reflective appraisal of views expressed. In addition to those immediately involved in the Project, interviews were conducted with New York University officials, members of the United Federation of Teachers, PCS advisory panel members, NSF officials, and various school district and Board of Education personnel.

Questionnaire and survey data were collected from pre-service interns, on-site coordinators, teachers and administrators in the public schools, PCS Advisory Board members, metropolitan New York and other selected colleges, recipients of Project publications, former PCS staff members, interns who had dropped out of the program, and all recent and former Project graduates. A case study was also conducted of the PCS involvement in another school district during its initial two years of operation. The bulk of the data referred to above are presented in Appendix Q of the full report.

The last major element of the evaluation consisted of an ongoing assessment of all Project communication. This effort focused heavily upon Project publications, particularly the Progress Reports, but also included the original and revised proposals for funding, Advisory Board minutes, internal correspondence, course outlines, papers presented at conferences, communications to staff and school officials, agenda for staff meetings, and a variety of external correspondence dealing with Project concerns.

The data collected from all these sources were presented and discussed at evaluation team meetings. The results formed the basis for planning successive stages of the evaluation. In terms of the views which are offered, the evaluators make no claim to infallibility. We can only state that we have attempted to insure that the important observations we offer are well supported. We believe they represent an accurate picture of the Project but understand that others, including the PCS staff, will find points of disagreement. As we have noted, the methodology which was employed placed a heavy emphasis upon the collection of observation, interview, and survey data. The conclusions we have reached have been extrapolated from such data with care exercised to be sure that they were confirmed by more than one source. It is our sincere hope that what has been assembled will prove of some use to the Project staff and others interested in making similar efforts.

II. Operation of the Project

A. Staffing and Organization

As we have noted earlier, the accomplishments of the Project have been limited by the size of the staff that was available. The problem this posed was not confined to staff size alone. That is, it moved beyond the sheer limitations of numbers to present further complications in regard to the variety of talents and skills that were available. In a project that was working in as complex and demanding an environment as this one, there was a constant need for a diversity of insight and understanding that was necessarily limited in so small a faculty. Given the ambitious intent of the program, it seemed that the scope of the talents needed was always broader than that which was available.

To point to such limitations is not to offer an implied criticism of the professional ability of the staff that was employed. Admittedly, the ambitious goals of the Project did place a premium upon the intelligent hiring of staff and a careful match-up of their skills to the tasks that needed to be performed. That issue should not be avoided and will be addressed in a later section. What is alluded to here is the simple lack of human resources and the restrictions that posed for a project with such a diverse set of expectations. The Project had available to it the equivalent of three full time faculty positions. In attempting to meet the many demands upon them, these postions were at various times spread out over as few as six and as many as nine part-time faculty members. While that met the need to expand the set of skills available, it left each member of the staff with other sets of responsibilities that

required their attention.

Faculty members working on the Project were to be released from an equivalent portion of their normal responsibilities. It is not easy to determine precisely the set of responsibilities of which Project staff was relieved. The number of faculty in the Department of Science Education had been decreasing for several years. Because of this, it is hard to determine how many persons were needed to conduct the normal business of the department, aside from the concerns of the Project. The separation between the Project and the department was not clear. In certain ways this was intended and necessary. To accomplish the intent of institutionalization the lack of separation was good, but in practice it meant that the remaining staff had to conduct all the ongoing business of the department as well as that of the Project. The organizational strain was obvious and was noted by PCS staff. It frequently appeared that PCS was added on to the normal set of departmental responsibilities, with key staff members assuming heavier loads to accomodate the needs of the Project rather than being relieved of other tasks.

Because of the lack of sufficient resources, there was a considerable premium on skillful organization, administrative leadership, and inter-departmental cooperation. In the opinion of a number of the former and some of the present staff members, these important conditions were not always satisfactorily met (See Appendix J). Much of the inter-department effort that was planned never came about. A portion of this was due to conditions at the University, discussed earlier. This, however, cannot account for the almost complete lack of cooperation from other departments.

Certainly, a part of the lack was also due to the barriers to cooperation which normally exist between departments. A certain resistance to such efforts, particularly when they are under the aegis of a single unit, could have been anticipated. A reasonable plan or design for dealing with such territoriality was necessary, but apparently did not exist. That represented a failure of foresight on the part of leadership, thereby denying the staff some much-needed help.

The Project was also handicapped by changes in administrative leadership. The influence of such changes cannot be fully evaluated, and it would be wrong to attribute more to them than is reasonable. Nonetheless, such changes at important junctures can and do have important consequences. The actual shift in leadership often is preceded by a period in which the impending change is anticipated, and the complete attention of neither the incumbent nor the incoming leadership is fully available. That can be disruptive, as can the normal change in leadership style and emphasis. In the case of PCS, the staff operated for a year with a Project Director who was present only two days a week. Thus, to the complication of a change in leadership was added the need for a certain division of administrative responsibility. That too provided some difficulty. Beyond this, since the Project was predicated upon an evolving definition of roles, it may not have been prepared organizationally to handle the types of problems it encountered.

After the New York City crisis (and perhaps again after the change in leadership), there appeared a need to reorganize, find new resources,

and use the staff in different ways. That this was not done seems, in retrospect, unfortunate. Surely the climate in and around the Project at that time had changed drastically. It was no longer clear that the original goals remained within reach, but it seems certain that they were not attainable in the same way or to the same degree that had initially been planned. That an extensive reassessment of purpose was not conducted should not be overstated as a fault. Considering the extent of the crisis, one could reasonably conclude that the PCS staff responded well enough to have survived and remain a viable force after it was over. Still, the choice was possible.

For the benefit of those attempting future efforts of this type, it may be useful to consider what alternatives were available under the circumstances. It would seem that the best counsel that might be offered a project staff facing changes as extensive as those which confronted PCS would be a recommendation to consider a thorough reorganization. This would include a complete re-examination of purposes, and of the structures that had been created to accomplish them. It simply does not seem appropriate to continue applying a construct which had been created during one period to a circumstance for which it may no longer be appropriate. It could be that the superior course of action in such an instance would consist of simply marking time while reassessing what is possible.

We believe that such a course of action would have benefited Project City Science. It is not that the failure to employ it emptied the Project of purpose or direction. The staff continued to do useful things. There is a

real possibility, however, that allowing the staff to remain fully engaged throughout the crisis was a mistake. PCS offered the schools a welcome service but at the possible expense of denying its own staff the time they needed to consider how to redirect their own efforts. A temporary halt might have allowed the PCS staff to react better to the changed circumstances and to even find means of capitalizing upon some of the unique opportunities these changes may have provided.

We noted earlier our concern about the Project staff's tendency to set goals at such an unreachable level that the practical operation of the program was conducted without real reference to them. The Project appeared to move increasingly into an informal mode where the relationship between behavior and purpose was not always clearly charted. The crisis described would appear to have reinforced that tendency. A temporary halt would have provided one means of rectifying the problem, allowing the staff to plan a better fit between what was intended and what now remained possible.

B. Modifications

In an earlier evaluation (See Appendix A), we noted a modification of the Project in which the formal model for institutionalization and change was apparently deemphasized and the dissemination effort expanded to replace it.* The shift in emphasis may have been dictated by a number of changes in the climate of the project at that time, though there is little record of conscious

*As will be shown in a later section the change model was not completely abandoned. Attempts to formally apply it were discontinued but some elements of the initial effort still remained.

planning. At that same time, however, the Project faced another set of circumstances which did seem to demand that important modifications be made. Having shaped its design and submitted an accompanying budget for the conduct of Phase II of its effort, the PCS staff found itself confronted with a fifty percent reduction in the funding that had been sought. One would have expected an adjustment in some of the broad aims of the Project which would have corresponded to the new set of realities dictated by so severe a cut. In our opinion, this did not happen.

The Project staff sought to make its adjustment mainly in one dimension, that of reducing the number of school districts with which they proposed to work. The revised proposal sent to NSF noted the need to "reduce staff and to eliminate or cut back certain activities." It goes on to indicate, however, that the major modification would be to substitute "intensity for extension," explaining that Project staff would work in two school districts rather than the four that had been originally proposed. What they did not attempt was to reassess the broad ambitions of the Project and whether or not they could still be accomplished. That decision seems crucial. In retrospect, it appears that the Project staff did not give sufficient thought to how the budget cuts would affect their ability to perform a number of the difficult tasks to which they had committed themselves.* The reduction was drastic. The analysis of what was now possible needed to be conducted at a level proportionate to those reductions. It was necessary

*What was at issue was not only whether such tasks could be accomplished but the quality with which they would be performed. Many remained within reach, but not at the same level of performance.

to determine whether the cuts were such that they would influence not only the number of locations but the actual scope of the problems the Project could address.

It surely seems that the influence the cuts would have on the central purposes of the Project was underestimated. This may have had results that continued to seriously hamper the effectiveness with which a number of Project activities could be conducted. One example of this, previously referred to, was the impact of reductions in the total number of staff anticipated in the initial planning. Such reductions had an expanding influence on the whole operation of the Project. That influence had to intensify when initial objectives were not satisfactorily adjusted.

As one begins to circumscribe the number of staff who will be available, it becomes clear that what is lost amounts to something more than mere faculty positions. There is a decrease in the scope of the interaction that is possible, the diversity of ideas exchanged, and the capacity of the staff to excite each other's interest and inspire fresh activity. In brief, the budget restriction posed more than a simple case of reducing the services that could be offered. The inner vision of the Project was itself affected.

It seems that two possible modifications could have been entertained at this point. One would have been a reconsideration of earlier objectives. That would involve a reordering of overall aims and not simply the working environments. A second consideration would have been the launching of a concerted effort aimed at making up for the loss of faculty. This would have included contacting other sources of help within the University to

find constructive ways to fill anticipated gaps in the Project created by reduced funding. Thus, one of two alternatives would have been expected: either a restriction of the original scope of the Project, or efforts to find alternative means of performing functions that would otherwise be detrimentally affected. Efforts at adjustment were made, but not at a level consistent with the budget restrictions that had been imposed. It seems that the Project staff simply miscalculated its own needs by assuming they could attempt what had originally been intended even when faced with such a grievous reduction in funding.*

C. Support for Implementation

In initiating a discussion of this type, the evaluators feel compelled to emphasize the intense difficulty faced by a project working actively in the schools. Much of what takes place in education conspires against risk-taking. Funded programs, operating in that same milieu, are far from exempt. It is easy to fail when there are so many elements over which no real control can be exerted. The broader the influence that is sought, the greater the risk. It becomes increasingly simple to have important things go wrong. The possibilities for interpersonal disharmony are greatly multiplied when one adds the variable of inter-institutional cooperation. Conflicts can erupt both within and between staffs. Inexperienced interns or faculty can use bad judgment that reduces or hinders Project acceptance. The prospects for failures are numerous.

*The PCS staff has referred to the need to achieve a "critical mass" in reference to its research effort. The term is lacking in specific meaning but the idea it attempts to convey is applicable in regard to the pool of faculty talent that Projects such as this require.

At the interpersonal level, this Project has handled its relationships with the schools quite well. The districts in which they are currently working want them to return. Their efforts are generally respected and their relationships remain positive. This is no small accomplishment and it has left the Project in a position where it can continue to work with and influence instruction in the schools.

In managing its field relationships as well as it has, the Project staff has not had a great deal of external support. As pointed out earlier, some portion of this may be their own fault in not overcoming the inertia and resistance of other departments at NYU. The University leadership, however, has not been of great aid in this endeavor. As at other universities, much is offered in the way of verbal support. University administration expresses the desire to see its staff involved in the community and offering aid. The individual reward structure for faculty and the broad university support systems, however, say otherwise.* From the level of Dean on downward there appears to have been insufficient appreciation of what was done, or support for what was being attempted. While prepared to acknowledge the Project's importance, little in the way of either material or moral support was offered. Despite the rather clear nature of the need for University support implicit in the proposal, the Project appeared to be very much on its own. Not even its success in managing its field relationships so skillfully seemed appreciated or much valued. In many ways, the University leadership seemed unaware of the opportunity that PCS represented. That opportunity, in our

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*The University continues to apply a one-dimensional reward system that honors publication as the sole activity meriting either tenure or promotion. Right or wrong, such a system militates against extensive efforts of this type.

opinion, went well beyond the confines of science education. It included a broad potential for working in the schools, and with other community agencies. In any event, less seemed offered in the way of support than would have been expected. Outside of what was funded, little was provided. It is difficult to see what the University contributed to the Project's efforts to accomplish its major objectives. In that respect, it seems that University leadership was far better served by what Project City Science offered them than by what they offered in return.

III. CRITICAL ASSESSMENT: THE OVERALL PROJECT

A. Funding Implications

The evaluation team has stated at several points its belief in the usefulness of this Project. It would seem appropriate to clarify and expand upon that belief, particularly in the light of some of the criticisms that have been offered. PCS constitutes an important effort. On a broad level it represents an attempt on the part of the funding agency to determine the efficacy of concentrating resources, focusing upon the support of large scale efforts rather than a series of smaller ones. The final estimate of such an outcome will take some years to determine. It is unclear at this point whether this Project will continue, or if it does, precisely what form it will take. Time alone will allow a determination of the Project's long range success in finding its own sources of funding and establishing its importance as a voice for science education.

One can, even at this juncture, however, offer some estimate of the reasonableness of such a funding approach. The evaluators, from their present vantage point (and we admit there are important limitations to what we can now see), believe that the experience of this Project raises some important questions which need to be considered when funding major endeavors such as this. On the one hand, the value of supporting projects with the broad capability of a PCS is recognized. That support allowed things to be attempted that thirty smaller projects could not have done. On the other hand, the PCS effort has given reason to believe that such large scale attempts often bring with them problems that are not easy to overcome. For example, when one launches an effort of this magnitude, it seems that it almost inevitably

results in the creation of a complex or sophisticated model. Such models are, by their very nature, often at variance with the systems into which their proposers seek to have them introduced. They are also efforts whose actual functioning often depends upon a partnership, but which have usually been exclusively conceived and developed by only one of the partners--the university. As noted in our earlier evaluation (See Appendix A), the inherent inequality of such partnerships frequently results in inter-institutional working arrangements that frustrate attempts at making permanent change. These twin dangers seem general, and future funding should be predicated upon a clear demonstration that they have been considered and that compensation has been made for their disruptive potential.

As is obvious, an organization such as NSF must make a number of important decisions about how funds should be allocated. Discoveries about the limitations of a particular type of funding in no way indicate a failure. Such efforts allow important understandings to be reached and thus, irrespective of results at the operational level, something of value will be learned from projects such as this. In regard to the funding of programs with broad intent, we believe the potential limitations we have noted above are serious and require attention. While we fully support what has been attempted through the PCS venture, believing it an effort that should have been made, we are not at all convinced that we would recommend that other such efforts be funded without assurance that some of the related problems have been confronted, and dealt with.

Project City Science is important at a number of other levels and these also need to be examined. The Project has provided an opportunity to discover the extent to which large urban school districts can be influenced, and whether different teacher training models can produce unique and even transportable results. As in the case of funding procedures, what can be learned is not limited to a narrow definition of "success." What the evaluation is seeking to determine is not simply how well a particular aspect of the Project has succeeded, but what has been learned and how effectively it has been reported. In such a view, even "failures" that lead to the raising of significant questions are valuable.

Because this is so, the evaluators have chosen not to shrink from a critical examination of issues both large and small in regard to this Project. As will be evident, we feel PCS has fallen short of its expectations at a number of levels. Nonetheless, the attempts, if openly examined by either the evaluators or the PCS staff, constitute an important part of the learning that can evolve. The danger we have tried to avoid is that of excusing the Project's failure to add to our knowledge by pointing to the hardships it faced or by focusing upon the nobility of the effort. That would be unfair to both the effort made and the results intended. The Project accepted the serious responsibility of attempting to further inform the science education community on a number of important issues. The evaluators have attempted to give that charge the serious attention it deserves.

B. Instructional Methodology

How effective is the classroom instructional model the Project is seeking to see implemented? We believe the Project has not made a significant contribution in this regard. Little that would add to the depth of our

understanding about the effectiveness of the "hands-on" approach, or that would improve our use of it, has been reported. It has not been the subject of serious research, or even extensive reflection by the staff. To a large extent, Project personnel seemed to begin and conclude their efforts with the assumption that such an approach was implicitly superior. Far too little was done to explore those assumptions in any detail or to offer supporting evidence.

One of the real problems with a "hands-on" approach is that students often bring to it a personal agenda that is non-lesson related. They come to the experience which has been prepared by the teacher with their own social and psychological needs. At least some of these will be directly contrary to the intent and the requirements of the learning that is being offered. Under such circumstances, the very structure of the "hands-on" approach can invite a conflict of purpose. Subtle responses and adjustments need to be made by teachers. The difficulties inherent in the approach must be candidly assessed, analyzed and dealt with, not ignored. Too much of "hands-on" teaching is built upon an assumption that interest and the need to learn will so far outweigh other considerations, that those considerations do not really require serious attention. There is far too little evidence that this is so, and the entire approach needed to be explored rather than given an <u>a priori</u> acceptance.

It is generally acknowledged that this teaching method rests upon the intellectual curiosity or at least the interest of the student. What is not so easily seen is the great difficulty involved in instructing teachers in its use. It is hard to understand exactly how one is "trained" in such an approach.

It has to be experienced, understood, even lived by the teacher before it can be passed on to anyone else. Personal acts of discovery are just that; if the teachers have not themselves experienced such acts with considerable frequency, they are ill-equipped to guide students in making them. This is as true for the university teacher as it is for the intern. Too often trainees attain the vocabulary without having experienced the process either deeply or often enough. Worse, they are left unaware that this is so.

That PCS did not entirely overcome the dilemma posed by this instructional approach is attested to by the relative infrequency of its use. The evaluators did not observe a great deal of "hands-on" instruction anywhere, including the university classrooms. Some eighty to ninety percent of what was observed at NYU was teacher lecture or group discussion. It was not common to see the teaching model so often spoken of actually practiced. The field experience was roughly similar with regard to the frequency of "hands-on" instruction observed. Observers in the schools, to a large extent saw a practical reinforcement of the instructional model most frequently practiced at the university. The PCS staff itself lacked a master teacher who could demonstrate the model in sufficient variety and detail. Most of the instruction viewed was quite traditional in nature - an observation shared by the majority of visitors to either Project field sites or NYU classes. (See Appendices F-H)

Perhaps if the approach had been more intensely examined and its possibilities more closely explored, greater use of it might have been seen. If the PCS staff had from the beginning treated "hands-on" as hypothesis to be tested, more of importance could have been learned about the specific conditions under which it does or does not work.* By assuming that it was the best instructional

*A number of science teachers in the schools in which PCS was located consistently reflected the view that as an instructional method, "hands-on" was more suitable for able students. Views such as that needed to be systematically examined, probably by the research arm of the Project. Unfortunately, they were not.

intervention available, PCS has left the science education community with the same questions, the same lack of knowledge, and the same gaps in its understanding. Too little has been learned from five years of project experience in this regard.

C. University - School Interrelationships

The schools serve a number of important purposes, and balancing them always presents a problem. The socialization function of the school vies with the educational, and often a real conflict is posed. Teachers, sometimes unconciously, struggle to maintain what is in their view a reasonable balance. Students are increasingly peer group oriented, and place great premiums upon the need to be liked and accepted. Thus the social aspects of school life compete with the academic for the student's time and energy. Some of the methods posed by teacher-training institutions implicitly require a considerable increase in the degree of socializing allowed. Teachers resist this, and perhaps they should. There are some deep and vital questions here that need identification and discussion. The university too often moves directly to answers rather than explorations, neatly ignoring some of the real problems. The schools, which have to deal with consequences, can afford no such luxury. The larger educational community needs to face the fact that schools ignore the advice of university teachers and researchers not because they are ignorant, recalcitrant, or both, but because they do not believe the real issues are being addressed. That belief may not be as inaccurate as critics of the schools would prefer to think.

Part of the difficulty is that few formal mechanisms have been established that would facilitate a real exchange of ideas between the school and the university. PCS attempted to create such a link in the form of an on-site coordinator. This did not prove to be a completely satisfactory mechanism. The

coordinators' professional standing did not seem strong enough for members of either institution to utilize them for such a purpose. That would have required more teaching and/or supervisory experience than most persons who filled that position possessed. Their status appeared to leave them ill-equipped to address institutional differences with authority, as several of the coordinators themselves pointed out.* A corresponding difficulty was posed by the fact that three of the eight coordinators this year were employees of the public schools. Due to the nature of their responsibilities, the degree of interaction with PCS faculty appeared extremely limited and little was done to use any of them effectively as a liaison between school and university.

In the absence of an effective mechanism, resistence to implementation efforts is likely to persist. The schools continue to offer opposition and those in the university continue to offer convenient explanations for the refusal of others to adopt their ideas. To accept their explanations would require the belief that the reasons for rejection are almost always unsound. That seems unlikely, and so deeper causes need to be sought. While teachers do not always take the time to offer a formal analysis, the constant refusal to adopt a particular approach should be viewed as something more than simple obstructionism on their part. There may be a basic flaw in what is being suggested, a real conflict between it and the environment into which its incorporation is being sought. The responsibility for discovering the conflict lies with the university; not the school. Since the university advocates the suggested change, the corresponding obligation of demonstrating the proof that the change has virtue remains theirs.

*It appeared obvious to several of the coordinators that in their capacity as key implementers of change in the schools, they were often not taken seriously by either group those in the University or the schools.

It is an obligation which has not frequently been accepted - indeed one that often appears to have been studiously avoided. It is a simpler task to condemn the schools, attributing the lack of acceptance to their extreme conservatism rather than the university's refusal to give up such comfortable rationalizations and seek deeper, structural courses.

There are two conservatisms at work here, but only one is generally identified. The university has for too long been expert at identifying the resistance to change in other institutions while remaining blind to its own entrenched patterns. It remains too tolerent of behavior that is comfortably self-serving, but has proven neither productive nor fruitful. PCS has been prey to this problem. The Project began with a heavy field emphasis. In the beginning, in-service workshops were conducted in the schools, and university faculty made frequent visits to field sites. Over the duration of the five year funding period, however, one can chart an increasing withdrawal of the faculty to the confines of the university campus. This seems part of a larger pattern for such programs. The staff begin with an emphasis upon working in the field but increasingly yield to the temptation to return to an environment in which they feel most comfortable.* There is a pattern of gradual withdrawal from what was the central arena of intended activity. During the last year of this Project, there were increasing complaints about the non-availability of even the on-site coordinators in the schools. Thus one is witness to the retreat first of front line university faculty, followed by what would constitute second line staff.** The schools note such withdrawal with more than passing interest.

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*The lack of power, authority and status within the schools are probably important factors in the gradual reduction of the university presence. The capacity to influence always seems greater when viewed from afar.

** The coordinators were not considered faculty.

That they draw appropriate conclusions about whether the university's ideas are workable in their environment, cannot be doubted.

The universities, thus, have their own problems to overcome. They often employ a one-dimensional approach for dealing with the schools that is inconsistent with their expectations of a flexible response. While the problem referred to above requires resolution, the overall dilemma is far from unique to this Project. That it was not overcome is not surprising. It is not noted as a special flaw but as part of a constant and continuing limit to innovative efforts initiated at the university level. Those employed there need to take a broader and more embracing view of the university's own conservatism, its resistance mechanisms, and its hostility to modifying long ingrained practices. They need, in short, a far more sophisticated approach to attempts at cooperative interaction with other institutions than they currently possess.

The interfacing of institutions is a complex and demanding process, requiring an understanding of institutional behaviors, and the development of distinct strategies or approaches. The NSF would be well advised to require a demonstration of such an understanding (and a well-designed plan to put it into effect) from any outside institution seeking funds to implement programs in the schools. This Project made reference to an institutional change model in its proposal, but never appeared to take it seriously enough to formally plan and apply it. Even then, the model was too "other-institution" oriented, reflecting an ethnocentrism that was ill-equipped to deal with the full set of problems inherent in such inter-institutional arrangements. For the scope of what was being considered, PCS took too little account of the types of resistances

they were bound to encounter. Even less thought was given to those to which they themselves might prove susceptible. The result was that the implementation effort was at best uneven, frequently uninformed.

D. Effecting Change

The Project had, as part of its design, the calculated use of key individuals who were to serve as agents of change in the schools. PCS had assigned this role in different ways to both its on-site coordinators (OSC's) and its interns. The strategy seemed to be to work at changing conditions in the schools by skillfully employing the talents of individuals filling those two roles. The OSC's, being professionally more experienced, were generally charged with greater responsibility in this regard.

Based on observation and interview data, a reconsideration of who would serve best as the agents of change is suggested. The evaluators would urge that the PCS staff contemplate training school personnel to fill this role. In particular, we would suggest working with administrators at the building level, and science coordinators (or other key personnel) from the central office. There is a need to interact with these individuals and discuss questions of deeper educational significance. By their own admission, school administrators have all too little opportunity to do this. They need to be invited in as joint partners: co-planners of key Project efforts. They need to be consulted about direction, and used in a way which would help them see themselves as conscious agents of change, with a particular purpose and an accompanying plan in which they have confidence. This will require developing a strategy with them, and clearly defining their role. Including them in such planning would not only employ their talent and experience, but would provide the opportunity to inform and direct the key implementers of such a strategy. This

would appear a more promising approach than that which has been attempted.

The training task is not an easy one and needs to be carefully considered. The resulting application would be far more direct, however. Further, if it proves workable, the potential dividends are much greater. One can make a real beginning at the development of model schools through such an approach. These administrators have a large say in employing staff and often set the standards for the school. Their normal institutional role allows them to hire teachers,* thus using their position to improve the quality of the staff and change the tenor of the school.

PCS appeared to believe that they could minister directly to what they felt was a small, well defined population: the junior high school science teachers. In retrospect, it does not appear that this was ever possible - at least not in the way that was assumed. These teachers are part of the total system. They work within it not outside of it, and cannot be separately influenced in the manner attempted. The whole system impinges on their day-to-day activity, exacting from teachers a behavior which conforms to the structural demands of the school. In some ways the Project staff seemed to know this, but in important ways they did not act upon it. It was a fault in the design that was never fully compensated for. The staff needed a better vehicle for making a fuller impact upon the whole system. PCS could have considered how to affect administrators and other teachers in order to influence science instruction. They chose the reverse route: attempting to influence the system through its science teachers. In such competition to influence teacher behavior, the university was badly overmatched. It would appear that attempting to use the natural

* This includes interns graduating from the PCS program who could presumably provide the foundation upon which revitalization could be built. As noted in an earlier evaluation (Appendix B), the Project failed to give much attention to seeing that their graduates were so employed.

structure of the system would have been a wiser course. It is possible that middle management, i.e. building administrators and subject area coordinators, are the most influential components in a large city bureaucracy. Their tenure is often more permanent than that of either the teachers below them or those at the superintendent level and higher. They are clearly more accessible, and more time can be spent with them.* They have the capacity to more directly influence actual classroom instructional practices. That they were not worked with more closely seems to have been a major error. They appear to have far more influence as potential change agents with both subordinates and superordinates than those the Project choose to use in this capacity.

Whether the PCS staff decides to use the administrators in the manner suggested or not, they must increase their interaction with them. The full burden of responsibility to effect change cannot be left to interns and coordinators. These latter are potential instruments which the Project staff and school administration might well employ to help implement decisions which have been <u>jointly</u> reached. They can serve an important purpose for the Project if used this way. If the original role planned for coordinators ever had a chance to work, it was dependent upon PCS employing exceptional individuals in that capacity: master teachers whose demonstrated example was so strong it could compel others to reexamine their approaches. The Project did not fill these positions with such individuals.** That failure vitiated whatever likelihood of success might have existed. To a large extent, the Project operated

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* Teachers, particularly in large, urban, unionized school systems, tend to leave immediately following the last period and are rarely available during the day. Superintendents are generally far too busy to give the problem of classroom instruction the attention it requires.

** While the staff was able, they could not be described as master teachers - - at least not within the realm in which the Project was working.

on the one had at too high a level for meaningful change and on the other at too mundane a level to be effective. Somehow middle management personnel were too little consulted or influenced, and on a day-to-day basis they are the ones who run the school system.

IV. GENERAL CONCLUSIONS

A. Vision

PCS represents an important and necessary attempt on the part of NSF to support innovative educational efforts. Aside from the strengths or weaknesses of this particular Project, the effort that has been made is important. Educators have recognized that the junior high school has been too long ignored. Many agree that it often represents a pivotal point in the life of students: a time in which vital decisions about their educational futures are being made. For all that educators acknowledge the importance of junior high schools, little of practical significance has been done to address or attempt to alleviate the problems so often alluded to.

Project City Science represents an attempt to deal directly with one of the problems. The original concept was sound and the Project's authors did not avoid the real issues. They chose to work in the schools, dealing directly with students and teachers, thus exposing the project to the risk of failure, in exchange for placing themselves in a position where they could make an impact. That risk was compounded since PCS choose to work not only at the junior high school level, but within an inner city urban setting that was experiencing declining economic conditions, increasing population shifts, and great problems with teacher morale.

The initial design for dealing with these problems was audacious in its vision. There were some drawbacks to that as will be noted in the next section; a conception so elevated eventually needs to be translated into concrete action, and that can prove a stumbling block. Nonetheless, in the initial stages, a

grand vision of what can be accomplished needed to be offered. Such a vision was provided. The design offered was prescient, anticipating interests, and pointing to an important policy direction. What was proposed was bold and imaginative. It pinpointed an area of need, and identified the separate resources which could be formed into an alliance to meet that need. The implementation of such a design was a separate matter, requiring a different set of skills. Translating theory into practice offers few guarantees. The experience of Project City Science has demonstrated again the difficulty of attaining objectives that are ambitious in scope and require major institutional adjustments to accomodate them. The Project was far less successful in meeting such objectives, and some of that can be tied to the very breadth of what was envisioned in the original plan.

B. Scope

The evaluators believe that an excessively optimistic set of expectations was entertained by the Project staff. This was also alluded to by the evaluators of Phase I of their effort.* A program that is overly ambitious in its intent - ambitious to the point of being unrealistic - can end up in a state of organizational confusion. Aiming high on the assumption that falling short will still result in important achievements, is not always a positive attribute. It can result in subverting project planning by creating a level of illusion that confuses program functionin., leaving the staff without clear direction. In such situations a dichotomy is often introduced between statements of intended purpose (which the staff begins to conceive of as ideals rather than guides) and actual behavior. The result is that statements of purpose and actual behavior become increasingly unrelated.

*The evaluation was conducted by the Center for Instruction, Research and Curriculum Evaluation (CIRCE). See PCS Progress Report 4.

Such a separation between thought and action appears to have been an unintended outcome of this project. Based upon observer and interview data, the connection between expressed Project purposes and actual outcomes was consistently weak. The ambitious scope of the proposed research effort, the design for institutionalizing change, and the attempt to create model districts were examples of goals set so high that actual performance was left without realistic guidance. This resulted in key Project activites often seeming random rather than purposeful, and discontinuous rather than aggregate in nature. In our view the "Progress Reports," while useful, reflect that discontinuity and lack of long range focus.

Despite the ambitious nature of its goals, the Project remained somewhat insular in its actual operation. Far too little outside help was sought. The Project's failure to make use of the New York University community is noted in Appendix B. With the exception of a portion of a single sociology course (dropped in the final year), only PCS staff were involved in the actual instruction of interns. We believe a number of outside consultants or guests could and should have been used. As one of the interns noted, "It would have been good if they had brought in a Black or Hispanic psychologist who could have given us a little better insight about the kids and their problems." There were a number of such special circumstances where outside expertise could have proven invaluable, and not all of it need have been financially prohibitive. Resources from the Board of Education and a variety of New York City institutions, including other universities, could have been obtained free or at nominal cost. There were, and are a number of minority coalitions, alternative schools and public service organizations willing to offer services or provide useful experiences.

A similar problem was the Project's lack of a broader vision of its purpose. It retained a narrow view, often seeing its role in specific New York City terms, and never really addressing the larger issue of inner-city instruction in science. Attempts to put staff or students in contact with science educators working in similar circumstances were far too infrequent. Drawing upon the experience of programs in neighboring cities was seldom attempted, yet the evaluation staff found there were individuals who were both knowledgeable and interested in sharing concerns.

Failure to seek these interconnections may have been an oversight, but it deprived the Project and its interns of views that could have been at once broadening and informative. It also served to deny the Project staff access to the potential dissemination outlets they were seeking. There seemed to be too limited a sense of responsibility to the wider audience of science educators. Operational aspects of the Project were conducted as if they represented mainly a local effort, with little being tested, developed, or offered in a form that would stand rigorous review. A better sense of their relationship to the broader science community might have encouraged a more effective use of available resources, and a wider scope for Project operation.

C. Status

If one is to be guided by recent "Progress Reports," the Project appears to consider that important elements which are transferrable have been completed.[25] The evaluators do not concur. The Project is, from our perspective, mainly a source of potential that has not yet been fully realized. The extent to which it will be remains unclear. Viewed in a favorable light, one may consider

that the Project is right on schedule. At the end of five years, they remain a viable force that is in a position to accomplish something. They are, in this view, an unfulfilled but possible source of good in the area of science education. Perhaps more could not have been expected than that the Project staff would have brought themselves into such a position by this time, although their own hopes were surely greater than that.

Regarding the Project's present status, the evaluators want to emphasize their view that PCS is not what it appears to be on paper. An extensive attempt to document that discrepancy is offered in an earlier report (Appendix A).

The Project's reports in which the staff assess their own endeavors, are, in the opinion of the evaluators, inflated in their optimism about both what has been accomplished and what remains within reach.

Projects such as this develop a certain isolation from the immediate world in which they live. There is a tendency to receive only data that reinforces a positive view of what is being accomplished. Some of this is natural. The work is hard, and positive reinforcements are few. It is not a strength, however, and needs to be resisted. It was not unusual to find that the Project staff discounted viewpoints from sources they considered either biased or unimportant. The concomitant phenomenon was that they were not profiting from what those sources had to say.* The Project was not well served by such attitudes.

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* The attitude was manifested in the Project staff's reaction to the views of some of the school personnel, as well as to their own interns. It is perhaps exemplified in the response to the CIRCE report, an assessment of Project progress which the evaluators believe was informed and accurate in its identification of prospective problems.

While the staff personally accepted criticism of their efforts with reasonable grace, there was not always a calculated effort on the part of the Project as an organization to obtain an unbiased assessment of how others viewed the quality of their work. A weekly hour with interns, presumably created to obtain feedback, was not well used in this regard. The Project staff dominated the time with administrative and program details. The hour was eventually subsumed by a course in the second semester. In the meantime, interns complained that their concerns were not heard. Considering the extent of the need for input, this seemingly casual dismissal of a valuable source was a mistake and should be rectified. Similarly, the Project's research staff was not frequently providing needed information about its operational aspects. In many ways, the Project did not have an external, unbiased insight into how it was functioning.

In the absence of either openness or access to such external data, the Project has clung to a grander vision of its efforts than has been warranted. This, in combination with an insufficiently restrained rhetoric, characteristic of the Project from its inception, served to blur meaning, obscure purpose, and cloud actual activities. It too often hid what the Project was truly accomplishing, perhaps because it was less than that which was intended or desired.* The earliest evaluation report said as much, though sometimes in unappealing language. Its counsel appeared to be ignored, and the Project

*In this, the "Progress Reports" were an unfortunate accomplice. The staff was required to issue them at three (later four) month intervals. It is difficult in such a short space to find exciting activities to report, and one is encouraged to use inflated language or begin dwelling upon future promises. The Project staff fell prey to both errors.

staff continued to believe they could accomplish the grander goals - the larger vision of their purpose. Those earlier evaluators concluded, and the present ones agree, that this was never possible, although a number of smaller but still important things were.

D. Planning

In actual operation, the Project was guided by the original proposal design. We have noted that the design was imaginative, and addressed itself to real and important issues. It was not without defects, however, and some of these caused the Project difficulty. A concern has been expressed about the scope and the depth of the impact anticipated in the original design. There were other difficulties. The proposal called for the deliberate use of a number of staff who had no experience with the New York City schools. There was also planned turnover of certain staff members at predetermined intervals. The rationale offered was not entirely convincing* and, in the view of the evaluators, the concept did not work well. The lack of familiarity with the mechanics of the New York City schools represented an obstacle to a number of the coordinators that was not well compensated for by the broader view of events which their inexperience presumably allowed. Indeed, some became effective only as they grew more familiar with the way the schools worked. This build-up of experience was often lost to PCS when, either through personal choice or by predetermined plan, such staff left the Project. Thus, the weaknesses of these positions showed up far more than did their assumed strengths.

Another operational difficulty the Project faced was the problem of planning changes in its own procedures to meet the new challenges that arose.

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*The use of staff without New York experience was an attempt to avoid a conformity to the views of the city system that does indeed exist. The planned turnover represented an attempt to view the coordinator's position as a vehicle for training future college instructors.

Even a Project that begins with the intention of remaining flexible has a tendency to fall into an operational mold. It appears that once a Project has imitiated program activity, it is extremely difficult to redirect efforts. A major impediment is finding the time to identify, discuss, and plan necessary changes. What this Project has demonstrated to the evaluators is the intense need to have organizational planning and objectives clearly developed prior to program operation. Once the Project begins, it may be impossible to recapture the planning time necessary. Events begin to acquire a momentum of their own and staff is often in the position of reacting to rather than directing them. It would appear that the day to day demands of the program no longer leave sufficient time for extensive reassessment or unhurried reflection about new directions.

If proper preparation is to be made, it is likely to be accomplished in one of two ways. The most likely of these is through the careful and thorough organization of the program in advance. This includes making provision for the staff to meet at prescribed intervals to assess, in detail, program progress. Such a mechanism must be provided in advance. A second method is that of halting program activity while planning a new direction, a course of action that seems justifiable only in extreme emergencies such as PCS faced. If finding the necessary time to plan changes in direction is as difficult as has been perceived, then a great premium must be placed upon developing a thorough operational design at the outset.

Important elements of Project City Science were not fully in place at the initiation of program activity. Some of this was planned. This was particularly true of faculty roles, which were not carefully described but were expected to evolve with experience. It was also true of the planning for model districts, which lacked detail in regard to key roles or how major objectives

would be attained. The research phase was similarly open-ended, not clearly identifying roles or assigning responsibilities. When the operational need for job descriptions that would avoid overlapping efforts arose, there were too many demands upon the staff to allow systematic planning. Weekly faculty meetings had to deal with many pressing issues and generated their own dynamic. In any event, they would have provided an inadequate forum for the extensive analysis that needed to be conducted.

In the absence of a formal structure to which one could resort for definition of roles and functions, PCS evolved an increasingly informal operational style. This had its strengths in that it allowed the staff freedom and flexibility. It also has notable weaknesses: the staff was neither thorough nor systematic in their efforts. A clear line of research was not identified until late in the Project's existence, though a number of interesting speculations had been offered earlier. The implementation of changes in the schools was not pursued in an orderly and precise manner. There were not consistent attempts at raising questions or closely defining concerns. The Project lacked an operational persistence, a clear definition of its major tasks, and an unyielding determination to pursue them in a manner that would identify important issues, raise substantive questions, or produce information of consequence to the field. Even the production of monographs portraying a host of school-related activities, or journal articles pointing research directions or identifying concerns, would have represented significant contributions. Such outcomes, unfortunetly, did not result.

On a different level, several consultants recommended that the Project employ a number of master teachers who could translate what was being suggested into classroom instructional practices. This appears to have been a sound suggestion. The lack of availability of such personnel hampered the Project,

and was noted by a number of interns and some cooperating teachers. Such practical demonstrations of successful techniques would have constituted a potent means of changing teacher attitudes and initiating the development of model schools. As one educational critic has suggested:

> There can be no significant innovation in education that does not have at its center the attitude of teachers and it is an illusion to think otherwise. [26]

The existence of the master teacher would have been a great aid in allowing the Project to translate its purposes into concrete, observable actions.

PSC also needed to address the organizational issue of developing effective intra-staff working relationships. There was an operational gap between clinical and research-oriented elements of the staff. Such differences are to be expected, and can even be productive, but they must be dealt with skillfully. They appear to have gone unattended, perhaps unrecognized, for too long in this project. Neither group clearly saw the other as a powerful source of aid in accomplishing some of their key purposes. Because of the nature of Project activities and the position of the clinicians, that group attained an ascendency in practical decision-making, which weakened whatever research effort may have been possible.* Here, then, was a program attempting to bridge the gap between universities and schools - which is wide, traditional, and multi-faceted - which had not completely resolved subtle divisions within its own faculty. The result was that the staff was left to implement its ideas without viable assessment of their impact or value.

The rift experienced by the staff was a minature version of the practitioner/researcher split that has long plagued a number of professions. Anything the

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* A lack of direction on the part of the research staff was likely an important contributing factor in the weak performance.

Project was attempting to accomplish would have to overcome not only such divisions within its own staff, but the resistance of teachers in the field as well. Because such opposition is so formidable, few innovative ideas, including this one, find their way into actual classrooms intact:

> Assuming that an invention is born, it must then find its way into the social network of the practitioner. The isolation of the research community from practitioners in education is legend. Geographic distances, status differentials (as between researchers and practitioners), legal boundaries, and a dozen other barriers inhibit its journey. Most innovations never make it so far. Those that do, like individually prescribed instruction, are transformed in the process. The final metamorphosis is performed by the practitioner, who blends the invention with other messages and shapes them to his own ends, which are certain to be removed from the vision pursued by the inventor.[27]

PSC was not particularly effective as an organization in dealing with this common but persistent problem in education. Too much of what was attempted yielded to, rather than overcame, this dilemma.

E. Legacy

On an individual basis, the Project has attained a measure of success. It has survived under extremely difficult circumstances, and may eventually obtain some local funding support.* That would be a good first step toward the ten years of non-federally supported activity originally contemplated. Viewed from a wider perspective, PCS has not thus far provided a great deal that can be passed on. The legacy of the Project in terms of particular outcomes is not strong. Its disappearance would represent more a loss of potential than anything the science education community or even the New York

*The most recent information is that the PCS staff has been unable to obtain outside funding for the initial years of its proposed Phase III effort.

City schools would immediately miss. They remain an unproven quantity - and as yet unrealized potential. Their significant contribution, if any, remains in the future - not in the past or present.

Some things have been accomplished. A number of interns have been trained and are working in urban junior high schools.* The Project's publications are appreciated and seem to have been well received by some of those to whom they have been sent. Most important, the PCS staff has developed a working relationship with a number of schools, and put themselves in a position to offer effective help. Personnel in the schools report that a relationship with the University is important to them. It challenges complacency, exposes the staff to new ideas, and invites reexamination of current practices. As such, it represents an association that has inherent value to the schools. PSC has filled this need.

One must balance these accomplishments with efforts that remain incomplete. The model districts are a long way from being formed and the dissemination effort has not yet resulted in the Project's being duplicated elsewhere. While the research staff has made presentations at several conferences, there has not been an article published in the five years of Project activity, nor is there any prospect that the Research Institute will be formed. While the Preservice Program remains the most fully developed of the Project's efforts, it also poses a number of unanswered questions, particularly in regard to its power to attract a sufficient number of students.

What the Project has done well is to establish communication with a number of disparate forces in New York that have an interest in education. The staff

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* Project records in regard to employment of interns are imprecise. It would appear that some 25-30 of the programs 1975-78 graduates are currently employed as teachers with as few as 10 working in urban junior high schools.

has developed good relationships with members of the teachers' union, educational administration, and several school-related institutions. Through effective use of an Advisory Board, they also have access to a varied and highly skilled pool of professional talent. This is no small accomplishment. In achieving these things, the Project staff may have placed themselves in a position where they can be an effective voice for science education in New York City. If Project personnel can scale down their ambitions and organize themselves to do better what they are realistically capable of accomplishing, they could make a real contribution. Theirs is a voice that can be helpful. What they have attempted is important and can be a constructive aid. To the extent that Project staff can focus their efforts on clear objectives and capitalize upon the influence they have gained, they surely have much to offer.

In saying this we in no way mean to imply that the Project staff has been successful in attaining their original aims, for we do not believe they have been. Nor do we claim they have attained their global objective, for clearly they have not. They are a small project doing some interesting things, a number of which are commonly done by other departments of science education. There is one notable exception. PCS has made political contacts and alliances within the New York City educational bureaucracy that are impressive, and unlike those which most comparable departments manage to achieve. They have laid the groundwork to become a useful and constructive force for science education in New York. In pointing this out, we do not suggest the Project is what its written documents imply. It is not. We do note that when the overstated claims that often obscure what the Project is doing have been scaled

down, they have the potential to do some interesting and useful things. A foundation has been laid and some good may result. The direction is not yet clear and the plan not fully formed, but if the staff uses what has been established in an imaginative and intelligent fashion, some of what was intended may yet result. Their considerable skill in establishing and effectively maintaining a network of communication with important elements of the educational bureaucracy can be used to help science instruction in the City. That much has been accomplished by the funding. It is up to the funding agency to determine whether or not that is enough.

F. Report Format

As has been indicated, the Project has four major operational aspects: The Preservice, Model Districts, Dissemination, and Research programs. In the sections that follow, a separate assessment is offered of each program component. The reporting in each part will employ a similar format. An introductory section will briefly explain the major purpose of the component as drawn from Project documents,* and will include a description of the program. This will be followed by evaluative comments dealing with that part of the Project. Each section will conclude with a set of recommendations related to the program under discussion. Both the evaluation and the recommendations which follow are based upon data more fully reported on in a separate set of appendices, which include two earlier evaluations of the Project. Readers with deeper interest and greater endurance are referred to the full report.

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* For a fuller review of the documentation explaining Project purpose, see Appendix A of the full report.

V THE PRESERVICE PROGRAM

A. Introduction

The preservice component of Project City Science may be the most fully developed part of the Project. In essence it deals with the recruitment, selection and training of graduate students to teach science in the inner-city's intermediate and junior high schools. This section of the report will deal with those specific efforts, and will include a description of the program, as well as a review of the preservice activities as described in progress reports written by the Project staff. The reader is directed to Appendices A and B of the full report, in which a number of the activities during earlier periods have already been discussed at some length.

B. Objectives of the Preservice Program

One of the four main products that were to be developed during the second funded phase of Project City Science's existence was a model preservice training program. The Project staff felt that such a program was urgent from several standpoints:

> As an institutionalized embodiment of the Project's philosophy, its standards and its approaches to inner-city intermediate school science teaching as an ongoing link to the model districts, and as part of a stabilized financial base for continuing Project activities.[28]

> In order that other universities may adopt a similar approach to the preparation of inner-city junior high school science teachers, the Project will have its system tested and in operation by 1980. Explicit descriptions will be available in the literature concerning all aspects of the program, including selection processes, field aspects, the content and structure of special courses developed for the program, assessment procedures and results, and placement outcomes.[29]

C. Program Description

The preservice training model which was ultimately developed included a masters degree program designed for individuals who had completed their baccalaureate degrees with majors in science. The approach was to seek out individuals well versed in science, who would then be given a variety of planned experiences in education. The training of interns would emphasize the need to understand the structure of the schools, the sociology of the inner city, and a process approach to the instruction of students. Except for the 1978-79 academic year cycle, these preservice interns were not given a stipend. Twenty-four of the thirty-two credits needed to complete the M.A. were offered by the Project on a tuition-free basis.

All coursework is conducted at New York University. During the early part of the school year (Sept.-Oct.), the interns are provided with a variety of orientation experiences, including workshops on various topics and visits to field sites. They also visit, on a rotating basis, each of the schools participating in the Project.* Eventually each intern chooses the school in which he or she would prefer to work, and, after consulation with Project staff is assigned. The time spent in the school gradually increases until the intern is eventually spending four days a week there. The fifth day is reserved for course work at the University.

Quarterly Report #8(covering the period from June, through August, 1976) notes that what the Project had been doing could not as yet be considered a

* In the 1978-79 school year, this practice was modified and most interns visited participating schools in only one of the two districts in which PCS was working.

program of teacher training. It remained at that juncture an assortment of experimental procedures and attempts that needed to be refined. The status of the preservice phase at that time, and the staff's hopes for its future development, were described in that report in the following manner:

> The Project City Science Preservice Program is not a program yet. It is a collection of many ideas and some experiences. Still, it is taking form, acquiring character, and before long should have established itself as something special. As it is now developing, the Program intends to have these features:
>
> 1. Selection procedures that identify those candidates most likely to become outstanding teachers of science to inner-city adolescents
>
> 2. An orientation experience that prepares participants to benefit maximally from the year's field and academic work
>
> 3. Heavy emphasis on field work that lasts an entire year and included citywide, neighborhood, school and classroom activities, as well as work with individual students in many different contexts
>
> 4. A progressive introduction to teaching, starting with tutoring single students and culminating with the simultaneous instruction of several science classes for an extended time period
>
> 5. A high premium on developing skills of self-analysis, including the frequent use of videotaping and audiotaping
>
> 6. Supervision of practice teaching by a team composed of a master teacher who has been specifically trained as a teaching supervisor and who is also personally involved in some creative aspect of improving intermediate school sciences, a university science education professor who is investing his or her research and development energies in the same schools in which the student teachers are placed, and a science education doctoral student who is preparing to become a professor of science education

7. A science learning experience that is the university equivalent, philosophically and pedagogically, of what science teaching at the junior high school level should be like

8. Special attention, including substantial field work, to the psychology of the early adolescent, to the sociology of the inner city, and to their interaction

9. Independent study opportunities provided to assist candidates in reaching a criterion-referenced knowledge of the physical, biological and earth sciences

10. A methods course that focuses exclusively on teaching science in grades six through nine and that faces up to the realities, both positive and negative, of inner-city schools

11. A set of intensive workshops on topics such as group dynamics, bilingualism, the reading problem, classroom research, and the like, that fill lacunae among, reinforce, or cut across topics dealt with in the scheduled classes and field work

12. A culminating group experience that helps each candidate reflect on his total year's experience in view of his or her own personal needs for self-actualization and approaching professional responsibilities

13. A built-in monitoring system for signaling the need to revise one or more aspects of the program

14. Linkage to continuing research and development activities that are also concentrated on inner-city intermediate school science teaching

15. Follow-up support for participants (job placement service; visits during first two years of inner-city teaching, if within range; newsletter)

16. Master's degree program in science education, specifically designed to build on and implement the preservice experience

Our aim is to develop a unified program incorporating the above features. Eventually an overall design should emerge that is distinctive, coherent and more durable than the individual parts making it up.[30]

The actual instructional part of the training program conducted at the college (1977-78) consisted of five basic courses; the psychology of the early adolescent, the sociology of the inner-city, methods of science teaching, curriculum, and science. The program for interns was as follows:

FALL		SPRING	
Integrated Science I*	(3)	Integrated Science II**	(3)
Psychology of the Early Adolescent	(3)	Sociology of the Inner City	(3)
Methods of Teaching Science to Inner-City Adolescents	(3)	Supervised Student Teaching	(6)
Science Curriculum	(3)		
	12		12

The training program, apart from providing specific instruction and a variety of important field experiences, was also to offer interns an example of the quality of teaching that would be expected of them. The Integrated Science courses were designed to organize the New York City science syllabus for grades seven through nine into four large units:

> Each unit will be designed using a different organizing principle: contemporary social-political issues (Energy); the power of science-based technology to change life radically (Science and Revolutions); universal themes (Movement) and scientific methodology (The Search for Simplicity). Each of the four units will include materials from all of the natural sciences.

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* It should be noted that the title, Integrated Science, is, strictly speaking, an in-house expression. The official title is Recent Advances in Physical Science.

** Recent Advances in Biological Science

> Furthermore, it is anticipated that the point will be reached in which each of the four units will employ a distinctly different teaching approach. In any case, in every pedagogical aspect (presentation, use of materials, testing, etc.), the teaching must be exemplary. As a result: our program participants will come to know what good science teaching is by experiencing it; we will have a reference base to use in the methods course; and we will be continually establishing our credentials as their teaching mentors.[31]

For their field experience, preservice interns are assigned to work with one or two cooperating teachers in the Project's school sites. The interns' initial responsibilities include observing and tutoring individual students or small groups. Eventually, they are expected to take over two to four teaching periods per day.

Each of the participating junior high schools has an on-site coordinator, assigned by the Project, who is available to aid the preservice interns in their efforts. The function of the coordinator is to help improve the quality of science instruction of not only the interns, but of the regularly assigned teachers in the building as well. By thus helping to create a model teaching atmosphere in the schools, the coordinators are seen as serving a vital and important purpose in the training program. Their presence as observers and their support of good teaching are considered key elements in the model the Project is seeking to develop.

D Overall Assessment

Evaluation judgments are based upon observations and interviews with Project staff, preservice interns, and cooperating teachers and their administrators. Additionally, some written data were collected from preservice participants, on-site coordinators and cooperating teachers.

Visiting observers, i.e. science educators, science supervisors, and teachers, also contributed their assessments of the Project. All observations, discussions, and interviews were conducted between September, 1977, and June, 1979.

1. Recruitment

The Project has consistently had a great deal of difficulty with recruitment. PCS has never been able to attract a large pool of prospective candidates. One possible reason is that there may be a very limited number of college graduates with undergraduate degrees in science who are interested in junior high school teaching careers. Further, such prospective candidates may tend to be more subject-matter oriented, and thus more interested in a high school teaching career. In New York City, a secondary teaching certificate is sufficient qualification for teaching in either the junior or senior high schools. Based on past experience, one is led to believe the senior high grades are more attractive to many candidates. The salary schedules are the same for both levels. Many feel the working conditions are not; with the junior high being considered both more demanding and less rewarding than working at the senior high level.

An additional deterrent is the fact that since the financial crises in 1975, the City's teacher salary schedules are no longer as attractive as they once were. It is also true that there are a number of career activities other than teaching available for those with undergraduate degrees in science that many consider to be more attractive. This may be especially true in the case of minority students.

In any event, the PCS preservice model has not proven its ability to attract candidates, despite the existence of numerous opportunities for science teachers in the City's public schools. The shortage has become so acute that the Board of Education, in cooperation with some branches of the City University, offered a twelve credit tution-free graduate sequence in the summer of 1978. Upon completion of the summer program, the participants were guaranteed one year's employment in the City's schools. Beyond this, a number of articles have appeared in newspapers describing the shortage. Thus, the availability of positions has been well advertised. This apparently has not helped.

Project City Science was able to get a description of its program included in the City's mailed responses to prospective teaching candidates. As a result of this mutually beneficial arrangement, the Project, according to Progress Report 15, received approximately seventy applications from which they were able to select eighteen students. This represented their most successful recruitment in terms of sheer numbers. The Board of Education, received approximately 2000 inquiries. While this suggests a pool of prospective applicants, it is impossible to know how serious the interest is or how many would choose the junior high school.

It is difficult to compare the benefits of the City's program with those of PCS. Obviously it would be easier for an unemployed individual to opt for a summer session that offers a promise of regular employment the following September, than to make a full time commitment for a whole academic year with no prospect of financial help. The shortage of science teachers was such that full time employment as a science teacher was a

reasonably good possibility even if the City warned that it was not "guaranteed." The availability of such an alternative has surely not helped the Project's recruitment efforts. On the other hand, PCS did not demonstrate its power to attract teaching candidates even when such alternatives did not exist, though again those data are confounded by the generally unsettled situation in the New York City schools over the past few years.

What then can one conclude? It would seem impossible to draw any definitive conclusions about the long range usefulness of the preservice model that PCS has developed. That it has not proven itself in the area of recruitment seems abundantly clear. To get others to adopt a model with such a deficiency seems highly unlikely. A model which does not attract candidates, no matter what its potential effectiveness, has little prospect of widespread use. Even if PCS manages to continue at NYU, its usefulness will remain minimal, for what school could afford to adopt such a program in an age of declining enrollment in the area of science education?

Whatever its prospects at NYU, PCS would appear to have limited appeal elsewhere without some major modifications being made. It seems that the program is more consistent with the circumstances of the Project's earlier funding than the realities of the present situation. Current conditions may simply have stripped once important elements of their potential. It is difficult to see how universities can become dependent upon a program that requires a graduate student to commit a year of full-time study when his undergraduate work has been in science - an area in which career alternatives do exist. Additionally, the need to have an on-site coordinator who will

sustain and support the training which the university has offered creates another expense in economically trying times. Financing such a position will prove difficult.

PCS has attempted some modifications of their program to adjust for these difficulties. These modifications are little tested as of this time, and how effective they will be in correcting the problems remains unknown. The role of the on-site coordinator has been assigned to personnel in the schools. That relieves the financial burden on the university, but, as has been noted elsewhere, its influence upon the original conception of the role may be such as to rob the position of its intended purpose. The Project staff have also been attempting to interest school districts in providing the financial support necessary to provide prospective candidates with free tuition. Should such financial support for trainees not be found, it is impossible to see how the program can survive. These modifications seem excessively risky and problematic for dissemination purposes. They remain untried and unproven, appearing to come less as the result of the Project's efforts to develop a theoretical base for a training program than out of the present need to find support. Had such attempts been made earlier, within the funding period of the Project, one might now have more reportable results about how well the approach has worked. Without such data, it is difficult to see what the PCS staff can assure colleagues is disseminable, though the model may continue and even prove workable for this particular department at NYU.

2. Selection

The selection process appears reasonably well orgainized. A set of procedures has been developed that can serve as useful guides. A copy of the PCS selection guidelines was sent to several knowledgeable staff members at different universities.* One of these evaluators characterized them as "appropriate and potentially useful," though not particularly unique. In general, the guidelines were seen as disseminable and of use as an outline for a selection process. It was felt they would need to be modified to reflect the particulars of any program using them, and that the interview procedures, as always, were completely dependent upon the professional skills of those using them.

The following table shows the selection and dropout rate in the final three years of federal funding:

Table 1

	# selected	# dropouts	% loss
1976-77	15	5	33.3
1977-78	19	4	21.0
1978-79	18	4	22.2

It is clear, that a number of students left for financial reasons, even when given a $1000 stipend for the academic year. Some students continued to maintain full time employment, which is not what the Project had originally intended. But whether students dropped the program for personal or financial reasons, a question is raised about selection procedures and how well the program retains its participants.

*Two local colleges were selected and the guidelines were sent along with an appropriate set of questions to staff engaged in the selection of students.

We believe the Project recognized the potential problems some of these students might have and still opted to accept them into the program. This risk-taking may have been brought about by the number and quality of the candidates available in the recruitment pool. For example, one intern, who went on to complete the academic year was never eligible, as a foreign student, to become employed in the schools of New York. Without reflecting on the quality of the student, who served the program very well in a bi-lingual capacity, it must be noted that there are some inconsistencies with program goals in such an arrangement.

It was hoped that PCS would attract a number of minority students, some bi-lingual, who would stay and work in the urban environment. The Project's record in this regard was above average. While as an urban project, it did not succeed in attracting minority members in proportion to the city's population. It did, however, attract a larger percentage (28%) of minorities than is usually found majoring in the sciences.

In brief, we believe that the selection process cannot be adequately evaluated. It appears that problems with recruitment prevented the established selection procedures from being applied as had been planned. The Project was often late in initiating its recruitment efforts, and rarely had the luxury of choosing from a large population of applicants. Considering the difficulties, the evaluators feel that the PCS staff performed capably. The interns recruited were generally able and served the Project well. A number of evaluators were impressed by the enthusiasm and professional interest of the trainees. Conversely, the Project did have a number of students who did not complete the program. While some of this can be attributed to ineffective post-selection procedures, financial limitations, or health reasons,

a contributing factor may have been that the Project has been in the unenviable position of being able to exercise very limited choice over its participants.

3. Orientation

The orientation process (described at length in Appendix B) allows the preservice interns to visit each of the participating schools, and to become gradually introduced to the variety of educational patterns that exist in the City's schools. During the final year, it incorporates a microteaching experience for the preservice interns.

In its present state, the orientation procedure is disseminable. The Project staff has continuously revised and modified this aspect of the program. The orientation period has been made shorter, limited to a single district, and has included within it some useful workshop activity. The weekend in the Poconos Environmental Education Center (PEEC) appears to result in enhancing the esprit d'corps of participants and in improving working relationships.

Any system will have some drawbacks, no matter how well designed. Some administrators were critical of the orientation process because the interns were not in classrooms in the early days of the school year. They felt the trainees were deprived of an important opportunity to see classrooms organized and pupil-teacher relationship established. Similar objections were voiced by some cooperating teachers who viewed the mid-October starting date as a loss of valuable time. Some teachers also expressed concern, and even dismay, at the "shopping around" nature of interns' visits during the period when they were choosing their

cooperating teacher and school placement. The process of having interns observe and select their field sites thus has some drawbacks, but it appeared to work well overall.

It was suggested by an administrator at one of the Project's field sites that more formal attention should be given to orienting the cooperating administrators and teachers toward their roles, and what PCS expected of them. This should not be taken lightly. Concern has been expressed that the Project had made good initial contact with the administrative hierarchy, but failed to continue the relationship once the interns were in place. There appears to be a strong interest on the part of administrators in maintaining continous contact with senior staff of the Project. Several indicated they would like to have some input at a decision-making level with respect to pre-service training, inservice courses, and field placements. Many administrators feel that they have access to a wealth of talent within their districts, and that this talent is not being tapped. Without such continuous input, they tend to regard the pre-service program as not much different from a regular program of student teaching, except that interns remain in the school for a full year.

In summary, the orientation process seems quite effective for the interns. It has been well planned, and capably handled. The procedures employed are both useful and disseminable. While it meets the needs of the preservice students, it does not adequately address the needs of the cooperating teachers and administrators. The Project would do well to make a greater effort at fostering strong relationships at the building and district levels, even after the initial relationships have been established.

School personnel also need to be oriented, i.e., given the program's goals, expectations, and operating procedures. They too could profit from being made to feel that they are part of a special program with unique features. One administrator suggested that a weekend at the Pocono Environmental Center be developed for school staff. This would allow them to interact at an informal level with Project personnel and preservice interns, developing the camaraderie that one of the PCS staff members felt was such an essential part of the program. The Project staff should consider conducting such a weekend.

4. Preservice Coursework

The teacher training program for interns is build upon a twenty-four credit sequence. Six of these credits formerly consisted of a course combining recent advances in Biology and Physics, referred to within the Project as Integrated Science. This course was offered during the academic years 1976-77, and 1977-78. It was organized around four central themes: energy, food, movement and the scientific world view. As described in the course outline, "Each theme is intended to reflect important aspects of formal science." Thus, the course was meant to provide a common content experience for a group whose background in content and scientific training span all the major disciplines in the natural sciences. It was designed to function as an interdisciplinary science content course rather than a typical science education course. The Integrated Science sequence was dropped in 1978-79 and two other courses substituted. An explanation for this change is given in Progress Report #14:

> The unevenness of pre-service students' science backgrounds persisted as an impediment to the effective presentation of the course; that is, the difficulty of making advanced topics in biology comprehensible to physics majors, and vice-versa. Although adjustments were made in 1976-77 and again in 1977-78, the students have continued to complain that some portions of the course were too elementary, and others too difficult. Rather than attempt to make changes in the existing course structure, a new course was designed to replace Integrated Science. While retaining an integrated science orientation, the new course will focus on the ecology of the urban area (Dynamics of Urban Ecology). It is hoped that the original broad goals of Integrated Science can be met... perhaps even more effectively in the context of the urban environment with which Project City Science is so identified.[32]

In addition to the reason cited above, the Associate Director suggested that the change in course sequence provided the pre-service interns with more pre-requisites, thus allowing them a greater degree of choice among the ten credits they must take on their own to complete the course requirements for a Masters Degree.

The two new courses, Dynamics of Urban Ecology (three credits), and Education for an Ecological Society (three credits), are new only in the sense that Urban Ecology was first taught in the summer of 1978. The courses were put into the catalog at the same time as the Integrated Science sequence, approximately four years ago. While some staff members were unaware of any decision to change the sequence, one believed that it was administrative policy to rotate courses. The instructor felt that the ecology sequence, while not the same as Integrated Science, was the same type of course, and that students could profit from both sequences. He was uncertain, however, as to whether one sequence accomplished the Project's purposes any better than the other.

An examination of the course outline for Urban Ecology indicates four major areas are investigated: energy flow, materials cycles, population dynamics and systems concepts. These themes appear to be consistent with an interdisciplinary approach to Science content. The thrust of "Education for an Ecological Society" is clearly different, in that it is more pedagogically oriented and deals with teaching methods and environmental curricula. This course's description does not appear to focus on science content. While students may find the content more relevant and applicable to their teaching needs, it does not appear to be a substitute for the Integrated Science course whose objectives was to:

> recall and apply at a formal level the content of each of the sciences (biology, chemistry, physics and earth science) that reflects the topics usually taught at the intermediate level.[33]

Though Project staff objected to the evaluator's suggestion that the change in courses was not carefully thought out, subsequent interviews have not convinced us that the process was thorough, or that the reasons were clearly understood.

During the academic year 1978-79, the evaluation staff spent a number of days visiting the Project courses, seminars, and staff meetings at NYU. In addition, the evaluation team made multiple visits to each intern at his or her field placement. College professors of science and science education, science supervisors, and science teachers from New York City and other urban areas were also brought in as consultants to observe the conduct of the course work and the activities of the on-site coordinators and interns in their field experiences.

It is the evaluation team's experience that course outlines reflect the intentions of the instructors with regard to rationale, content topics and

term assignments. Outlines cannot convey the quality of the teaching performance, or the enthusiasm, excitement, and scholarly interests aroused within the students. Thus we are interested not only in examining the written outlines of the course work, but also in examining how they were translated into action in the reality of the classroom. This view is in apparent agreement with the intent of PCS when it suggested:

> the teaching must be exemplary...our program participants will come to know what good science teaching is by experiencing it...[34]

The course outlines are, for the most part, competently done. They clearly reflect the intent of each instructor. The Integrated Science sequence and the alternative Ecology sequence have been written with care. We find the course assignments to be particularly interesting, and in many cases unique. The readings are up-to-date, appropriate and sufficiently rigorous. More attention is given to urban issues in the Ecology sequence than in the Integrated Science and we regard this as a plus. While it appears more appropriate, however, there is no evidence that this course sequence was any more effective in preparing the pre-service interns than was the old - a view which is shared by the instructor.

The revised Psychology course, in its outline, also appears to address some of the concerns expressed by last year's interns with regard to classroom management, and learning theory. The case-studies assignment associated with this course is also viewed as a positive attempt to provide interns with some insight into the backgrounds of their students as part of the pre-service teacher work.

The Methods and Curriculum course outlines remain virtually unchanged from previous years, reflecting little of the urban thrust one might have expected from a Project such as PCS. The lack of any modification from last year suggests that these courses are in their final stages of development. The Implementation course, presented for the first time, does not have a clear outline, and the evaluators do not feel it is well organized or clearly focused at this time.

In general, the evaluation team and its consultants were not enthusiastic about the quality of the classroom sessions at the University. In spite of the fact that visits were usually scheduled beforehand, little teaching which could be described as exemplary was seen. Classroom sessions were for the most part mundane and uninspiring. Consultants frequently raised issues about the relevance of classroom discussion to the inner-city situation, the rigor of the content, and the enthusiasm of the presentations.

One evaluator felt the presentation had little relevance for either the interns or for the students they are preparing to teach, while another evaluator indicated that the expected urban emphasis was not strongly evident. Such comments should be disconcerting to the Project staff, for they raise questions about whether the coursework truly differs from that of other departments of education. One consultant observed that little was seen of dynamic exemplary presentation, of urban orientation, and especially of teaching strategies suitable for use with academically disadvantaged children. These comments did not reflect upon a single course, but were in response to the full range of Project coursework.

This perception was not unlike that expressed by the Project's preservice interns, who appeared to entertain similar views about the courses taught at the University. Fourteen of the interns participating in the 1978-79 program were asked to identify the most disappointing aspects of Project City Science. The course work was prominent among the items mentioned. The results of the interviews are presented in Table 1 below:

Table I

DISAPPOINTING ASPECTS OF PCS

Disappointing Aspect	Number	Percent
1. No team feeling/no support	4	28.6
2. Courses too shallow	4	28.6
3. No curriculum developed to start hands-on	3	21.4
4. Nothing	3	21.4
5. Inflexible program	2	14.3
6. Project goals too high, unrealistic	1	7.1

A review of the consultants reports shows an almost uniform concern with both the content, as presented during the observations, and the quality of the delivery of the lessons (Appendices F-H). In fairness, a few classes were judged to be good, however none of the evaluators reported seeing anything exemplary, and the overall tone of such reports is not encouraging. These views are consistent with the pre-service interns' evaluation of the courses given both in the 1977-78, and 1978-79, cycles - a view shich did not change despite major course revisions in the final year. A sample of specific items from the intern questionnaire is offered to illustrate the point. The complete questionnaire and an analysis of intern responses is included in Appendix Q.

A sample of the responses is given in Table 2 which follows.

Table 23

1. Overall, how would you rate the project related courses you took at NYU during the year?*

	Poor 1	2	3	4	Excellent 5	
1977-78	(0)	(2)	(6)	(7)	(0)	(N=15)
1978-79	(1)	(1)	(10)	(1)	(0)	(N=13)

2. Overall, was the coursework applicable to your classroom situation?

	Definitely No 1	2	3	4	Definitely Yes 5	
1977-78	(0)	(1)	(10)	(3)	(0)	(N=14)
1978-79	(0)	(4)	(6)	(3)	(0)	(N=13)

3. Do you believe there were important ommissions in your preparation as a teacher?

	Definitely No 1	2	3	4	Definitely Yes 5	
1977-78	(3)	(5)	(1)	(4)	(3)	(N=16)
1978-79	(0)	(2)	(2)	(7)	(2)	(N=13)

4. Was the coursework consistent with your teaching needs?

	Definitely No 1	2	3	4	Definitely Yes 5	
1977-78	(1)	(3)	(7)	(5)	(0)	(N=16)
1978-79	(1)	(5)	(6)	(1)	(0)	(N=13)

* The questions employed a five point scale and the number of interns responding is given in parentheses under the appropriate rating. As can be seen, the majority of responses cluster in the "average" range.

Questions regarding a PCS model for science instruction fared no better. No student responded "definitely yes" when asked whether he or she had been given a clear model for science instruction. The evaluators interpret these responses to mean that the pre-service students were neither overwhelmingly enthusiastic nor overwhelmingly critical of their course work. The majority, in both years, saw the coursework as average. We concur with the students in this regard.

In the Haile "Report on Interviews with Preservice Teachers and On-Site Coordinator in Project City Science" (Appendices C-E) the change in coursework most frequently suggested (Table 12) was to "Improve instructors, presentation or change instructors" (Five students, 35.7% of the class) For a fuller and more detailed view of preservice attitudes toward their training experience, the reader is referred to this report.

The field experience is the most important single aspect of the students' training. Students appeared to find this the most rewarding experience, in terms of preparing them to work in the classroom.* This is a traditional view, held in most teacher education programs. While the extended two semester field placement was regarded favorably by the participants, the evaluators believe that this field experience could be enhanced through the use of planned observations. Neither the Preservice interns nor the on-site coordinators were specifically trained in observation or supervision, in any formal sense. This is a specific example of where New York City personnel could have been better utilized to offer assistance.

Most interns were not observed on a regular schedule, and both the interns and their cooperating teachers reflect this pattern. We believe the on-site coordinators are a critical element in the PCS model, and yet, as the program

* See Appendix Q.

is currently structured, they are frequently not available to the intern. Five interns stated that either they felt they had no coordinator or that he or she did not play much of a role for them. More than half of the interns expressed concern about the unavailability of the On-site Coordinators. A summary of the perceived deficiencies in the coordinators' role is shown in a sampling taken from interviews with interns.

Table 2

AREAS OF DEFICIENCY IN COORDINATOR ROLE IN PROJECT

Areas of Deficiency	Number of Persons Responding	Percent
1. Lack of availability/time	8	57.1
2. No on-site coordinator	3	21.4
3. No evaluations/observations/feedback	2	14.3
4. Lack of experience/finesse as supervisor	2	14.3
5. Lack of experience as a science teacher	1	7.1
6. Doesn't serve as a teaching model	1	7.1

As presently constituted, the coordinators are torn between their duties as liaison with the schools, and their needs as doctoral candidates. If the model is to be transportable, this role will have to be clarified. The alternative approach of using a school employee presents similar problems of availability.

E. Placement Outcomes

The Project does not appear to have developed a formal network for maintaining contact with its graduates, and until recently its placement service appears to have relied heavily upon casual telephone contacts to convey job information.

Data supplied to the evaluation team in June, 1978, indicated that the Project was aware of only one graduate teaching in a city junior high school, and the job status of 11 of its previous 25 graduates (1976-77) was "unknown". That same month, the Project began a more formal survey of its previous participants.

During its five years of operation, 57 students have completed the PCS pre-service sequence. Fourteen of these students are in the current (1979) class, and it would be premature to include them in the placement figures for two reasons:

a) They may be completing their M.A. degrees, and not yet be in the job market.

b) They may not have had sufficient time to be placed as of the writing of this report.

In May, 1979, PCS provided the evaluation team with a list of 40 former participants and their educational and career status. Of the 15 graduates in the class of 1976, nine appear to be teaching - one possibly in a city junior high school - five are listed as teaching science in public or private high schools in New York, and the remainder are teaching out of state.

Of the 10 graduates in the class of 1977, all are listed as teaching. Four are teaching science in the City's intermediate or junior high schools, one is working for PCS as an on-site coordinator, three are in suburban junior high schools, one is out of state, and one is in a private school.

Five of the fifteen graduates of the class of 1978 are employed in the City's intermediate or junior high schools; one does per diem subbing, another is a

part time science teacher in a City adult education program, one is a teacher in a city high school, and four others are teaching in suburban and private schools.

In summary, of the forty participants listed as Preservice graduates during the first four years of the Project's existence, no more than ten are known to be regularly employed in the city's intermediate or junior high schools. Presumably, the current graduating class of 14 will increase that number.

F. Project City Science Staff Assessment of Outcomes

Interviews with Project staff were conducted during May, 1979, to offer individual faculty the opportunity to state what they felt PCS had accomplished in the preservice component during the final three years of funding. It became apparent during these discussions that a major source of satisfaction for the staff has been the long-term, in-depth interaction with the pre-service intern. The staff felt this allowed them to build a good relationship with the interns, while at the same time enabling them to observe their professional growth over a year's time, both at the University and in the field.

In general, the staff felt that the accomplishments "had been diffuse." Specifically, the Project had established itself in the City, and by its presence, had upgraded the science program in the schools by supporting science fairs and, through extended teacher support--improving morale. One staff member expressed the belief that the Project had been successful in that it had "begun a training program to teach teachers to relate to the community and to groups outside of the school."

There appeared to be some difficulty in identifying specific components of the preservice model which were unique to Project City Science. One component was obviously the graduate support within the school personified by the on-site coordinator. Another was the interns' overriding feeling of "belonging to a project designed explicitly for junior high school."

This sense of accomplishment was for one staff member "a gut reaction" based in part upon teacher feedback.

In terms of a transportable model, the components most frequently identified by Project staff were:

1. The extended time the interns worked in the school
2. Clustering interns with an on-site coordinator
3. A team approach; a sense of belonging to a Project that focused on a single school level- in this case the junior high school
4. Courses that provided a variety of teaching techniques

On the last point, there was some uncertainty expressed about whether the PCS courses as presently constituted would be "universally beneficial", but it was felt that a science content course (Integrated Science, Urban Ecology, etc.) was a step in the "right direction".

One final outcome identified by a staff member was the attempt to incorporate "a sense of visual literacy" in the participants through the use of photography, video taping, and other course assignments. There was some uncertainty as to whether this was a personal direction of certain staff members or a conscious, deliberate effort on the part of the Project.

G. Summary

In the final analysis we must ask whether the Project City Science Preservice Program has done any good, and whether, in fact, it should have been funded. With all its faults, the evaluators must conclude that the answer is yes, though, as has been made evident throughout the report, there are a number of reservations. Despite drawbacks, the program offered to do something that few others were attempting, to wit:

Preparing junior high school science teachers, and

addressing the demanding needs of the inner city schools.

While we do not believe that a disseminable model has been generated, the Project has shown that it is possible for a large urban University to develop cooperative working relationships with a complex bureaucratic structure such as a New York City school district. While the Preservice Program has not produced large numbers of science teachers, it has developed an approach which appears capable of introducing teachers to classrooms in the inner city schools while minimizing their culture shock.

The Project tried a number of things which did not work, it has had some small success. It has awakened an interest in science in some children by institutionalizing science fairs in school buildings, encouraging the submission of mini-grants in science, and causing a number of teachers (however small) to stop and reflect on the efficiency of their own teaching techniques. The Project could not have been expected to anticipate the financial crises of New York, or the change in its own leadership which gave rise to a costly period of confusion.

We believe that the Project made errors in judgment. That was inevitable. It was, after all, an ambitious attempt to solve a major problem which too few

educators had sought to address. It is always easier to look back and recognize the warning signs. To suggest that such signs were clearly evident is offered less as criticism than instruction. What then, can be learned from the present experience? Project City Science has been an effort to effect educational change. In any such endeavor, the key is the relationship between the various interested groups (school, university, community, union). The question that needs to be raised is what has the Project done to explain these relationships, and to inform the various communities of their successes and failures? What does one do to implement change? Who must be approached, and what are the administrative power levels appropriate for different types of decisions? At which end of the educational spectrum does one begin? What influential personnel did the Project approach, and with what success? Who did they miss? On these broad issues, PCS has not been particularly informative. Five years of field-centered activity has not resulted in a set of guidelines about project or school functioning that might be useful for others embarking on similar ventures.

The Project staff, in the view of the evaluators, have not been sufficiently reflective about an experience that is quite unique. A contributing factor to this was the lack of organizational rigor and direction. The Project staff established a set of purposes that required a determined, well-organized effort if they were to succeed. The actual implementation was loosely organized, and it is questionable whether the style adopted would ever have allowed the staff to meet its expressed intention of elaborating upon a basic structure for a university-based school support system.

Throughout the life of the Project, concern has been expressed about the scope of the task assumed, and the resulting problems which would be posed. A

consistent thread, stressing the need for a more organized approach to the problems that confronted the Project can be traced. These include comments from within, as well as without the Project, and they began early. In June of 1975, a member of the Project's Advisory Board offered a number of suggestions illustrative of these concerns:

The advisor began his observations by stating that the Project needed a change model. He stated that the Project must assume that teachers know more about how to improve the situation than they can implement, instead of assuming only lacks and deficits on the part of the teachers. He was concerned by the lack of commitment which the districts show, and the lack of access which the Project has to district resources. He felt that each district should show its commitment by establishing someone as a liaison person, giving space on-site, and providing access to the administration. The advisor also felt that there was a lack of university support. Overall, he believed that the Project needed to adopt an explicit change model or strategy, perhaps by adding an organizational change specialist to the staff. He felt that the Project should concentrate on analyzing a science education support system in each school, and address itself to the question of how to move from what is to what is wanted. He said that such change requires an open acknowledgement of support by those at the top and science coordinators/supervisors must become more involved, while principals and A.P.'s must be brought in - perhaps by granting them adjunct professor status. He suggested addressing the science teachers in the schools as a group, in order to establish a norm structure.*

The advisor further questioned the Resource Teacher strategy, asking whether it was fully applicable. He suggested a broad application, crossing school and

*Minutes of Project City Science Advisory Board Meeting, June 6, 1975.

even district lines, suggesting that roles must be clarified, and phases of the operation spelled out more clearly.

The advisor's comments reflected a number of the observations which the present evaluators have since reached independently. The problems of junior high schools in the inner city are exceedingly complex and difficult. They will not be resolved by casual inquiry. A more determined effort will need to be launched if workable alternatives are to be discovered, and the conditions under which they might be suitably used reported accurately. The preservice program has developed some useful ideas which can be employed in the training of teachers. Efforts to implement change in the schools and to make a broad impact upon the structure have been much less successful.

H. Recommendations

1. The Project needs to examine the specific skills of its own staff, and optimize their use.

A key to the success of any project of this type lies in the proper use of staff skills. The Project's staffing was weak at several key points, in that staff skills did not match up well with the sets of responsibilities and tasks that needed to be performed. It is clear, for example, that not all staff members functioned equally well in a teaching situation, though they may have had compensating strengths which could well have been used in other areas.

There are also dangers inherent in attempting to build what is a large and important project upon a staff that is virtually nonexistant.* Such a circumstance greatly increases the number of variables that must be dealt with. It puts great pressure on the hiring of staff, for many key roles will need to be filled with personnel whose talents, attitudes and potential contributions are unknown quantities. This adds a considerable element of risk. Perhaps

* Apparently there were more faculty in place at the time of the original funding. These positions were not maintained by the University during the refunding period.

it was this, combined with an open ended design, that ended up compounding this Project's problems. NSF would be well advised in the future to consider carefully what staff resources are in place at the time support is sought, and how many key roles remain to be filled.

2. The Project must develop better means of obtaining information from their preservice interns.

The Project instituted a one-hour seminar on Monday afternoons, the purpose of which was to provide interns with a forum for expressing their concerns, and the Project with an opportunity to receive feedback. As the year progressed, the PCS staff appeared to gradually ignore this function of the seminar, so that by the end of the second semester, it had become an introductory period which blended into the implementation course.

During the past two years of the evaluation, a variety of highly useful information was collected by the evaluators from on-site coordinators and preservice interns. The same type of information could have been gathered by the Project staff and had an effect in shaping their professional efforts. The Project had the services of the research staff and a better effort could have been made to not simply test the interns but seek their inputs in a formal and consistant fashion over the course of a school year. A similar problem existed in regard to following up graduates. Far too little was attempted and an invaluable source of data about the Project was lost.

3. The Project must learn to use the free talent that is available in the New York City School District.

The Project generated a great deal of enthusiasm during their initial contacts with cooperating districts. A number of these district people knew the schools, knew the curriculum, and understood the attitudes and aspirations of the populations in the intermediate and junior high schools of

the inner-city. The Project either did not believe these individuals possessed such understanding, or deliberately chose not to use their expertise. Whatever the reason, a valuable resource was here again lost. Greater cooperation and use of such resources might have helped make the Project more effective in the schools.

4. The Project needs to make greater use of consultants - especially those from minority backgrounds.

During observation of Project courses, and again during interviews, the evaluators heard minority group students disagree with interpretations of the needs of minority children given by the staff. For a Project which is directed toward the needs of inner-city children, and which appears to encourage an anthropological view of the culture and society, there was not a sufficient understanding of the problem. Minorities are not well represented on the Project staff. A better effort could have been made to adjust for this lack by inviting Black and Hispanic psychologists and/or science educators to help in the training of pre-service interns.

5. The Project Director and senior staff should become more visible at the District level.

Senior staff members from New York University lend an added sense of importance and prestige to the presence of the Project. Occassional visits to the District could only contribute to the impact of the Project in general, and might also enhance the efforts of on-site coordinators and interns as they seek to fulfill the roles assigned them. The Project has underestimated the importance of the leadership being more visible in the schools. A concious effort to increase their presence would also serve to set a tone for other staff members and perhaps begin the necessary process of increasing the amount of time spent in the schools.

6. The University must learn to separate Project business from the business of the department.

The Project is a full-time venture. The University's continued demands upon the department helped to deplete the Project staff's time and absorb their energy. Because of financial arrangements within the University, the department and the Project frequently shared the time of staff members. It was not always clear that this "sharing" freed faculty from former responsibilities. Such overlapping arrangements also allowed the department to place non-PCS participants in the Project courses, something which seemed likely to erode the interns' feelings of participating in a special project. The attempt to meet both sets of responsibilities was difficult, and frequently fragmented staff energies.

7. The Project needs to draw upon a broader base for its instructional efforts.

If the Project wants to teach in an interdisciplinary manner, it must become interdisciplinary, building appropriate contacts within the University. Almost the entire teaching load is borne by graduate students, adjuncts, and Associate Research Scientists. Essentially, four people teach all twenty-four credits in the program - science content, education, psychology and field supervision. The Project may be trying to do too much by itself. Involvement by other departments could provide new perspectives, different expertise, and perhaps a new insight into persistent problems - e.g., designing a more satisfactory course structure for the integrated course in science content.

8. The Project might wish to consider establishing a line of institutional research.

The doctoral students in the Project frequently expressed concern about developing a suitable dissertation topic. The Project deals with preparing science teachers for the inner-city intermediate and junior high schools in New York City. It seems likely that the staff could identify major strands of research they wish to see pursued, and encourage candidates to investigate the possibility of exploring topics within those areas. Candidates for positions as on-site coordinators would thus have an implicit understanding of the nature of the research expected by the Project. Such coordination could help establish PCS as an important center of research activity for inner-city science education.

9. The Project needs to direct its efforts to the specific curriculum of New York City.

The Project was not designed to write curriculum, and yet the preservice interns were frequently asked to design hands-on units or activities that are not specifically related to the New York City curriculum. Like it or not, the teachers in the City's junior high school's are committed to a specific curriculum. They want to learn of more effective ways of teaching that which the system wants them to teach. Different aspects of curriculum projects such as ESS and SCIS may be fun and exciting to interns, but many of the New York City junior high school teachers cannot relate those activities to their programs. The Project needs to do a better job in teaching its trainees and coordinators how to apply its instructional methodology to a given curriculum. The ability to make such translations would also represent a reasonable proof that the instructional approach suggested has been conceptually understood and not simply verbally acceded to.

VI THE MODEL DISTRICTS PROGRAM

A. Introduction

The term "model district" was first used by PCS staff in its revised proposal for re-funding, submitted to NSF in March, 1976. There it was indicated that at the level of funding available, the Project would work toward achieving four products, one of which would be the development of two "model districts". A model district was defined by the staff as "one in which there is the highest possible level of intermediate science teaching in the schools." Specifically, the following attributes proposed by the Project described a model district:

> 1) Student achievement in science would be at or above national norms and higher than in city as a whole. Compared to other inner-city students in their grades, model district students would be more inclined to like studying science, with a larger fraction electing to enroll in science courses in higher grades. The number who elect science-related careers would be at least equal to national norms.
>
> 2) A larger proportion of teachers of science in a model district would be outstandingly competent. They would know how to teach science to all kinds of children under a variety of circumstances, and they would enjoy doing so. They would understand and respect both their students and themselves for what they are, and for what they are becoming. They also would have a continuing interest in science, and would make a serious effort to deepen their understanding of it and to stay up-to-date on recent developments.
>
> 3) Teachers in a model district would join forces with administrators and university professors to improve science instruction continuously. This means they would conduct periodic studies of all aspects of the science program (including its relation to other programs in the school) and they would take action based on the findings. To this end, the administrators would endeavor to insure that the science teachers have the working conditions and other support they need to achieve improvement goals. As a result of such continuing upgrading of the science curriculum, teaching methods and learning materials would reflect the best thinking in the profession at any one time.
>
> 4) The teachers and administration would consider teacher training and research as major responsibilities of the district, because both contribute to the improvement of science teaching in their district, and because as members of unique and special districts they would be in a position to contribute what others cannot. Thus they would be engaged

in a continuing symbiotic relationship with a major university.

5) The science program and efforts to improve it would be understood and supported by the parents and other citizens of the community in which the district is located. This would be reflected by the improvement, on the one hand, of parents in the ongoing program assessment activities, and, on the other, by the presence of school science activities in the community.

6) Most of all, in a model inner-city district there would not only be a receptivity to new ideas and a willingness to put them to the test, but also a constant outward flow of ideas, techniques, knowledge. The place would be demonstrably alive.[34]

Three mechanisms or programs were suggested in the proposal as a means of moving toward the development of a model district. (a) Inservice staff development, the publication of Citiscience Notes, and (c) the design of resource materials. A multitude of activities subsumed within these three programs and carried out by Project staff constituted the "raw material" for evaluating this phase of PCS.

Review of Prior Reports

An initial evaluation report of Project activities during the 1977-78 Academic Year,* and submitted in July, 1978, concluded that:

(1) There had been limited progress towards meeting the goals of a model district as originally detailed by PCS staff.

(2) Activities were undertaken by the Project which indicated a movement from the creation of model districts to "model schools," i.e., places where an administrative arrangement of support exists between schools and the project.

An interim evaluation report**, covering the Project's activities during the Fall, 1978, semester and submitted in January, 1979, concluded that officials in the schools in which PCS has been working do feel that there have been some distinct advantages. However, as one moves outward to the larger educational

* See Appendix A, pp. 1-113.

** See Appendix B, pp.114-175.

communities the Project intended to serve, its impact seriously diminishes.

The material for the present evaluation report was collected during the Spring, 1979, semester. Like the two reports that proceded it, it contains a commentary on the Progress Reports written by Project Staff that became available during this period, interview data, conclusions, and recommendations.

B. Update of Recent Project Activities

The interim evaluation report of January, 1979, provided a history of the model district phase of the project as revealed in PCS written communications, specifically the Progress Reports. This historical exploration of the Project began in the initial evaluation report of July 1978 and is concluded here with a brief analysis of Progress Reports #14 and #15.

One measure of the importance to be attached to the analysis of these progress reports can be found in the remark of the Associate Director and coordinator of the Model Districts Program:

> What is written is what the Project is - an outline of at least 80% of the Project. The information from interviews and observations can push us towards an even more complete picture.

Inservice staff development and design of resource materials are two mechanisms suggested in the PCS proposal as means of moving toward the creation of a model district. Progress Reports #14 and #15 describe activities under a "Clinical Professors Program" as the key to inservice staff development, while a section on "Curriculum Adaptation" describes PCS efforts in the design of resource materials:

1. The Clinical Professor Program

Progress Report #14 covers the period from June 1, 1978, through August 31, 1978, which was a time of internal assessment of this program by PCS staff.

It reports that, "the staff held many discussions during the summer of 1978, and submitted many written critiques of what was and was not successful in this model to date and how improvements could be made." Unfortunately, this progress report does not indicate the specifics of any of these discussions or critiques. What was successful and what was not successful in the model? The report is silent on the very question it raises. Such important omissions have been a constant problem in Project reporting and a source of concern to the evaluators. Key ideas or events are alluded to but not fully explained. This recent report, like so many others, is less a report on progress than on Project intent or prospects. To wit, "their university training is being continually refined" (p.10); "This program needs to be further developed" (p. 11); "a further important part of this description will cover ... (p. 11); "the next year will focus ..." (p. 11).

Progress Report #15 reflects on the Clinical Professor Program activities from September, through December, 1978. PCS reports that, based on an analysis of their jobs, "a checklist evolved regarding the Clinical Professor's daily and weekly tasks. This list was used at the weekly meeting during the fall term to emphasize all that needed to be done by an effective change agent as (a) supervisor, (b) coordinator, and (c) resource person." Although no checklist is provided, the function of each of these roles is described, "As supervisor, each doctoral candidate contributed to the decision regarding which preservice student would do best in a particular school (and once in the schools), ensuring that each intern was able to profitably follow the weekly schedule...The

coordinator's role was to see that the intern would gradually assume more and more classroom involvement...The role of resource person for the clinical professors (was carried out) mainly through their work in adopting curriculum materials for use at inservice training and workshops."

During the past semester (January, through June, 1979), the Clinical Professor Program was carried out mainly through the roles described above. The effectiveness of this program is described in a section of the report where observations and interviews, including comments by the on-site coordinators (i.e. clinical professors) themselves, are analyzed.

2. Curriculum Adaptation

Under the heading "Curriculum Adaptation", PCS describes its effort at designing resource materials - one of the mechanisms suggested for creating a model district. Progress Report #14 states that "over the summer, each of the coordinators took on the task of adapting some of the newer national curriculum development efforts to the standard New York City Board of Education Curriculum. The task of each was to prepare an overall rationale for the sequence of topics and general approach and explain why material in the original curriculum was rearranged, omitted, or supplemented. This advance preparation would provide teachers with new materials and new approaches when they were ready to try them out."

Progress Report #15 describes how this adaptation task was to be disseminated. Each coordinator presented his ideas to the other coordinators and to the PCS faculty. Then, a hands-on workshop for the pre-service interns was held.

Finally, inservice teacher workshops were to be held in the individual schools by the coordinators. During the past semester, interns used some of the adaptations in their classrooms. A description of these curriculum adaptations is provided in Progress Report #15.*

C. PCS Staff Interviews

To assess the Project's view of progress in the Model District program, a number of questions were posed to its staff. How well did PCS staff think it did in accomplishing the goals of a model district? Defining a model district in his own way, how does the coordinator of this phase of the Project view its progress? How did the on-site coordinators evaluate their involvement in the Clinical Professor and Curriculum Adaptation Programs - the two mechanisms suggested by PCS as means of creating a model district? In the following section, the views of the coordinator of the Model District program, the on-site coordinators, and pre-service interns are presented. The responses are useful in clarifying how the Project viewed its efforts in this area.

1. Views of the Coordinator of the Model District Program:

The faculty member responsible for the overall coordination of the Model District Program indicated that there were four ways that the Project staff defined a model district:

(a) Ideally the goal of a model district program is to help create places where science is taught well. A lot of teachers are doing hands-on activities; there is excitement in the kids about science and the administration backs this up.

(b) Organizationally, the Model District Program is an administrative arrangement with principals, supervisors, superintendents, teachers, Board of Education, and the UFT.

(c) Operationally an NYU, the Model District Program is the training we provide. We put a coordinator to work in a school with two interns, and spell out the roles of each.

(d) In a social reality context, the Model District Program, when made operational in the schools, takes into account inner-city problems, morale, discipline, money, research, community, etc.

PCS itself is a training program; a pilot program trying to find the best way. I'm not saying that we had the best way to enter the system. We are continually trying to refine the way we operate, so that it matches the realities of the schools. We said many things at the beginning. We got in there, found things that did not work, and documented the reasons they didn't work. We are very conscious of the need to get something done.

The Coordinator was asked what he believed were the key elements of this component of the project. He indicated his belief that there are three essential things that should be taken into account about Model Districts:

(a) None of the on-site coordinators had previous training as supervisors. You really can't expect them to perform well at the outset without previous training in the kind of job they were doing.

(b) All the pre-service interns are brand new each year, coming from different backgrounds, and so the training program has to be very fluid and imaginative to bring them into the system in a productive way. The role of the co-ordinators is the key to the Model Districts Program.

(c) The Program Director was new, and he had to come in and get a grasp of a very difficult program. It is a complex program to get a handle on, because it is so amorphous and tries to tie in with so many things.

In the course of the interview, the Coordinator was asked how he would have used additional funds had they been available. His response was that such funds would have been employed to bring in a number of:

> knowledgeable (outside) consultants (to) plan at the very beginning a research activity that would have given us direction for our other activities. I would have hired consultants who know the schools in the city - who could give us material that I can't find in a typical literature search. I would have hired a few more people that could do the job that we are doing in the schools.

The Coordinator was also asked what he felt the Project had learned from the Model District component of its operations. He noted that the recent experience of PCS with District 15 was perhaps most illustrative of the progress being made in this regard:

Essentially, the involvement of PCS in District 15 began as a result of a PCS annual advisory board meeting held in October, 1977. An official of the New York City Central School Board suggested that districts should be invited to an information sharing meeting re their participation in Project activities. After several discussions between New York City Officials and members of the UFT (February, 1978, and April, 1978), a meeting was held in May, 1978. Eleven district superintendents attended. A letter sent out to the districts early in the next school year (October, 1978), resulted in District 15 requesting that the Project start working with one of its schools, I.S. 142, as soon as possible. The Project was able to begin at once.

The principal at I.S. 142 was informed about the Project through the superintendent. The principal nominated one of the science teachers as a coordinator. This coordinator began participating in classes at the university. Two pre-service interns were sent to the school and worked with four science teachers in the building.

The program coordinator summarized his remarks this way:

> Now, in terms of District 15, we have a model that people said would work, and it has, in fact, worked very well. Last year (1978) when we met with the superintendents about obtaining financial support, there was strong agreement that this was the model they wanted: The on-site coordinator should not be a doctoral candidate, but a district school person. The person would come to the University regularly to classes for upgrading his expertise, and for organizational meetings. This person would possibly be a future assistant principal in charge of science, or a district science coordinator or supervisor.

Finally, the program coordinator was asked to assess the ways in which the Model District phase of Project City Science succeeded. He noted his belief that it has succeeded "in that it is a viable model that can work if we have enough of the right kinds of inputs and enough time." He went on to define the inputs in terms of people at all levels:... "administrators who will give support; coordinators who are capable and are willing to be open; in-service people in the schools who are willing to bend a little bit to new ideas. (And we need) recruits--pre-service recruits who have a good science background, and enough energy."

2. Views of the On-Site Coordinators:

In March, and April, 1979, interviews were conducted with the 8 on-site coordinators involved in PCS. Four of the coordinators were doctoral students, one was a masters degree candidate, and the other three served while also holding faculty positions within the participating schools. During the interviews, the coordinators were asked a number of questions about preparation for their roles and execution of responsibilities (See Appendix B). Among the questions asked and the responses received were the following:

Table 3

(a) Did the project prepare you to perform your supervisory function?

Yes	1	(12.5%)
No	5	(62.5%)
No need	2	(25.0%)

(b) Was the overall training sufficient?

Yes	3	(37.5%)
No	3	(37.5%)
*Not applicable	2	(25.0%)

(c) Did your job of Supervision coordinate well with your responsibilities as a doctoral student?

Yes	0	(00.0%)
Some	2	(25.0%)
No	2	(25.0%)
Not applicable	4	(50.0%)

When asked about their joint weekly meetings with the Associate Project Director, three coordinators stated that they did not attend these joint meetings because of their assignments as faculty members in the fieldwork schools. One was unable to attend because meetings conflicted with university coursework. Another attended rarely due to work connected with a doctoral dissertation. The three coordinators who attended the meetings regularly reported satisfaction with the way in which they were conducted.

*Several of the on-site coordinators were school district personnel and did not feel they needed supervisory training.

Six of the eight coordinators stated that they had not received training in how to keep a diary, conduct observations, provide feedback to interns, or other supervisory tasks. Of these six coordinators, five indicated that the concept and format of the diary had evolved during the course of the year. One coordinator stated that he had received training in certain supervisory tasks, and another indicated that some training had been provided. It is obvious from such comments that the Project had allowed itself to become greatly dependent upon the coordinators' personal capacity for organizational analysis and self-instruction.

More than a third of the coordinators felt that the initial Project goals were unrealistic and needed to be adjusted to the situation found in the New York City schools. Again, such adjustments were more frequently personal than organizational. From the perspective of the Project, they varied in terms of how sound and effective they were. Setting goals which were not actually possible led to the inevitable sense that there had been a lack of Project achievement.

One coordinator noted:

> The Project started to admit that the goals were unrealistic. We came out from trying to change a district to trying to change a school. And, eventually, we were trying to change teachers in classrooms. So, in a way, that's an admission of the fact that there was a discrepancy.

Three-fourths of the coordinators felt that the school administrators and teachers perceived the coordinator's essentially that of a resource person. From the viewpoint of the evaluators, this was a major impediment to the formation of model districts. The on-site coordinators represented

a key element in the PCS plan to change instructional procedures in the schools. The fact that the school personnel viewed them in such a narrow way greatly restricted what they could contribute. What the Project must decide is why such a view prevailed and to what extent it was influenced by the type of personnel selected by the Project to fill these positions. As can be seen from Table 4 below, the coordinators felt they were perceived by school personnel predominantly in terms of resource aid. They did not, however, appear to see that role as limiting.

Table 4

Role of Coordinator as Perceived by Teachers/Administrators

Role	Number	Percent
1. Resource	6	75.0
2. In-service, Informal training	2	25.0
3. Department coordinator	1	12.5

The most popular means by which the coordinators elicited the cooperation and understanding of the other teachers in the schools was through individual contact, especially during preparations of a science fair (See Table 5). One would have hoped that the role of a change agent, instructional leader, or curriculum advisor would have been among those things mentioned, if not highlighted.

Table 5

Means of Eliciting Teacher Cooperation	Number	Percent
1. Individual contact (as through a science fair)	5	62.5
2. Acting in role of colleague or supervisor (dual role)	2	25.0
3. Outside agency offering assistance	1	12.5
4. Fliers in teacher mailboxes	1	12.5
5. Assistance to Special Education Teachers	1	12.5

3. Views of the Pre-Service Interns:

The views of interns in regard to the formation of a model district were also sought. A questionnaire was administered to each of the previous two groups of interns (1977-78 and 1978-79). In it, the following question was posed: Do you believe your school would serve as a visible model of effective science instruction? Of those expressing an opinion, six said yes and eighteen said no. A second question asked if the interns believed the classrooms they were working in would serve as visible models of science instruction to which other teachers should be invited. Of those who expressed a view, twelve said yes and eleven said no. The interns are not experienced teachers. The depth of their professional insight can reasonably be questioned. Nonetheless, the views expressed do not inspire confidence that at the conclusion of five years of effort, the Project has been very effective in establishing a high percentage of model classrooms, let alone schools or districts.

C. Evaluative Comments

The immediate purpose of the Model District Program was to produce model science classrooms. These were to be places where science was taught well; classrooms where a great deal of hands-on activity was taking place, where an excitement about science was generated. The evidence, collected from classroom observations, questionnaires, surveys, and interviews is conclusive: Model science classrooms remain an ideal, elusive goal.

That this is so does not come as a surprise. The attempt to bring about change in complex bureaucratic organizations is not easily accomplished. Such efforts require a well conceived design and a highly systematic approach. The Project, in our view, met neither condition. The effort rested upon a structure that was informal and personalistic. As Sarason points out, "Good ideas and missionary zeal are sometimes enough to change the thinking and

actions of individuals; they are rarely if ever effective in changing complicated organizations like the school with traditions, dynamics, and goals of their own."[37]

The Associate Director and the coordinator of the Model District Program indicated that organizational, operational, and social reality considerations were the program phases that had to work to bring the ideal model district into existence. A careful analysis of each of these phases with special attention to the following issues provides several kinds of useful information: Were the original project plans workable? Were the plans modified, and, if so, were these modified plans workable? What were the major problems faced, and how did the project respond to these problems? Finally, what was accomplished and what was learned?

1. The Organizational Phase

Organizationally, the Model District Program is an administrative arrangement between the Project and principals, supervisors, superintendents, teachers, the Board of Education, and the union. It would be useful to examine how well this support system has been developed with each of these groups.

(a) Did the Project establish and maintain a supportive arrangement at the district level with the superintendent and district science coordinator?

The Project established initial contact with the superintendent's office and the office of the district science coordinators.* The district science coordinators were also responsible for the contact

*In the new district (15), initial contact was with the superintendent.

with the building principals and assistant principals. After initial contact, far too little was done to maintain an active, sustaining relationship with these coordinators. As one commented, "Although there initially was talk of a partnership, none ever developed." That a close working relationship with these coordinators was not sought and maintained seemed a serious miscalculation. As noted earlier, their loss as a personal and organizational resource seems a waste that the Project could ill afford.

(b) Did the Project establish and maintain a supportive arrangement with the principal, assistant principal, and teachers at the school level?

The project did establish and maintain a supportive arrangement with the principal, assistant principal, and teachers in the schools. As one school administrator expressed it, "Project City Science contributes to school services rather than drains them." This individual was pointing out that the typical pre-service teacher arrangment requires a great deal of administrative support and effort to work successfully, since the university usually provides so little on-site guidance for trainees. The presence of an on-site coordinator not only alleviated this burden, but provided yet additional help for in-service teachers in the way of ideas, materials, and support for experimental efforts.

(c) Did the Project establish and maintain a supportive arrangement with the Board of Education and the Union?

The Advisory Board members included members of the Board of Education and the Union. Although the Advisory Board stopped meeting regularly in 1977, informal contacts with individuals were maintained by Project staff. Specifically, a network of communications was established and maintained between the Project Director,

Associate Director, Board of Education personnel, and officials of the United Federation of Teachers. This relationship seemed to be effectively maintained, and was used by the Project staff in its efforts to disseminate their ideas to other districts.

(d) Did the Project establish and maintain a supportive arrangement with the University?

This arrangement was important but the support did not occur. The Associate Director's comments are instructive in this regard:

> That's a huge problem that is often not reflected on--the university's feeling about a field-based project. The university pays (little) attention to the time it takes to run a program - and it doesn't matter how much money is coming in. They have their own criteria about people and what people have to do in terms of university standards, and they (don't try to accomodate) projects except in minimal ways.

The evaluators agree that the evidence that the Project was not the recipient of strong support from the University.

2. The Operational Phase

Operationally, the Model District Program consisted of placing a coordinator in a school to work with two interns, and spelling out the role of each.

(a) How well were the coordinators chosen and prepared?

The PCS selection process for choosing coordinators has evolved to this point: The coordinators will be district or school persons; they will not be doctoral candidates from the university. The coordinators will come to the university regularly for classes to upgrade their skills. A coordinator chosen may possibly become an assistant principal in charge of science, a district science coordinator, or school supervisor. The PCS staff considers this new method of selecting coordinators to be a positive response to interests expressed by the school district in

having their own experienced personnel fill this role.

A different point of view with respect to coordinator selection was offered by an outside evaluation team of science educators. They state:

> The project has faced dilemmas such as the decision regarding the choice of coordinators. If these persons are employees of the school district, then they are responsible to the school district first. If they are university employees, then their decisions need not be accepted by school district personnel. Over a four-year period it would be hoped that PCS staff would have gained the confidence of school personnel so that the NYU staff could serve as coordinators, and so that their decisions would be accepted, even though these decisions might create extensive changes in methodology, curriculum, etc.[38]

The evaluators concur. The key to making coordinators effective is in the selection and training process. As was noted in our earlier evaluation, and in the dissemination section of this report, it is believed that employing school district personnel in this role may seriously alter and diminish the power of the model. The entire concept begins to closely resemble the approach to training pre-service teachers commonly in use i.e., the daily supervision of the trainee is conducted by school personnel with university staff making infrequent observations.

The evaluators have suggested the need to work more closely with school district personnel, particularly building administrators and supervisors. Such individuals should be closely consulted, and their involvement in training programs on implementing change encouraged. The role of the coordinator, however, is a separate concept. In creating it, the Project understood the need to have its supervisory influence sustained by a university representative on a more consistent basis. To do less would be to surrender

the power to nurture the philosophical views and instructional techniques the university is seeking to inculcate. One may quarrel over the adequacy or effectiveness of the training that the University offers, but the ability of the schools to impose their views on trainees who are inadequately supported during their field experience is unquestioned. In the training model commonly in use, it is the schools which provide the final and most powerful influence upon impressionable trainees. It is difficult to see how the university can assume financing of the role of the coordinator, but without it one of the major features that makes the pre-service model unique may be lost.

(b) How well were the interns chosen and prepared?

Intern selection and preparation, like those of the coordinators, was not uniform, and produced mixed results. On a questionnaire administered to the past two groups of interns, negative to neutral responses were given by the majority to questions on subjects such as ratings of N.Y.U. courses, applicability of course work to the classroom, and adequacy of their preparation to become science teachers.

(c) How effective was the procedure for choosing participating schools?

The Progress Reports would lead one to believe that an elaborate and objective system for selection of districts was evolved. Interviews with key persons involved in the Project simply do not support such a notion. Rather, selection of the districts and schools within those districts was conducted on a more personal, informal level. Surely criteria were developed and applied, but interviews with all involved do not leave the impression of rigor that is implied in subsequent reports. The evaluators do not

believe that an effective criteria on school selection that would be useful to other projects has been developed. Overall, the participating schools allowed the project considerable operational flexibility. Administrators were generally friendly to the project. Too few models of good science teaching, however, were available in any of the schools selected, and both interns and coordinators noted that deficiency.

(d) How well were the roles and expectations of the coordinators defined?

Progress Report #5 offers a reasonably good attempt to define what the role of the coordinator was to be.* Unfortunately, little evidence exists to support the notion that this defined list of rules and expectations served any fundamental purpose in the selection, training, or internal evaluation of this phase of the Project. For example, the expectation that the coordinators would serve as change agents was not followed up with any systematic or specific instruction on how to accomplish tasks as change agents. Such instruction would have included work in supervisory technique, organizational behavior, and those personal and bureaucratic mechanisms employed to resist change. To the best of our knowledge, little such instruction was provided.

3. The Social Reality Phase

In the social reality context, the Model District Program is what the Project actually does in school, taking into account inner-city particularities (discipline problems, particulars arising from community parameters) and issues such as teacher morale and psychological make-up.

(a) To what degree did the Project direct its attention to these inner-city particularities?

Not nearly enough efforts were made by PCS staff directly or

*See Appendix VI, pp. 1-7.

indirectly to isolate specifics related to the inner-city. No evidence, for example, exists that a thorough review of the literature was ever undertaken. Further, little has been done to develop a systematic training program for either pre-service or in-service teachers that would provide a useful framework for addressing these issues. A number of observers commented on the absence of an identifiable focus on inner city concerns in the courses being taught (see Appendix C). While the coursework dealt with difficulties interns would face in the schools, there was little that would characterize the instruction as essentially different from that of any other departments of teacher education.

The Project also attempted to develop a deeper awareness of the ways in which schools and teachers functioned. These views were sometimes used to provide the underpinning for operational aspects of the Project, but were often not well tested. The Associate Project Director, for example, spoke of the usefulness of interns as change agents, especially during the Spring months of the academic year: "In March, April and May, the pre-service interns are very much the change agents. They have all the energy - the regular teachers are tired..."

In the experience of the evaluators, this was not so. The interns, with the addition of their heavy course loads at the University, were often as tired as the teachers by the end of the year. More to the point, many of them were preoccupied with coursework and/or obtaining teaching positions, and had abandoned efforts to effect change. Not only did the teachers not accept them in the role of change agents, but most of the

interns themselves did not accept this role as realistic. One of the interns summarized this feeling best when responding to a questionnaire item that asked what was the greatest frustration the Project presented. His response was:

> Being introduced as a panacea for the school, when in actuality I was unprepared, inexperienced, and scared.

4. What Was Accomplished; What Was Learned?

No evidence has been collected (for this final report) which would modify the viewpoint of the initial and interim evaluation reports: There was limited progress towards meeting the goals of a model district as originally detailed.

Some things, however, were accomplished, and many things were learned. Among those outcomes and learnings which appear useful are the following:

(a) One way to tie the school and community together to get parents to appreciate what the school is doing, is to sponsor school events such as science fairs. (This seems like a traditional thing to do but it did accomplish a purpose). Similarly, this can become an effective way to make the school administration aware of, and sensitive to, the efforts of the science department.

(b) To get a school's inservice staff to become aware of the Project's presence and to get a school's inservice staff to have confidence in the Project as a resource in science education, have the Project team volunteer to inventory, then organize the science materials and equipment for the staff.

(c) To increase understanding of the relationships between the schools and neighborhoods and to foster better understanding and communication between schools and communities, the Project should sponsor and involve preservice teachers in anthropological research efforts as a training device.

(d) To sensitize pre-service teachers to schools being entered for the first time the Project should have pre-service teachers record their observations and impressions in a prescribed format and discuss them with University staff and colleagues.

(e) To encourage pre-service students to increase their contacts with school personnel and students and to understand the complexity of the institutions in which they work, the Project involved the pre-service students in observation tasks within their respective schools. They encouraged group analysis and discussion of data collected and compiled.

(f) To increase understanding of various situations in the schools, in order to aid the coordinators in solving problems there, regular staff meetings for such personnel should be held. Meetings should focus on supervision of pre-service interns, work with inservice teachers and administrators, review of progress during the month, and planning for the month ahead.

(g) To encourage non-Project teachers to use new curricular materials, have the Project staff prepare and distribute a list of science objectives and Project activities for the semester to all the science teachers.

How much progress has PCS made? Has the project arrived at a level of understanding that, if examined carefully and developed further by others, will lead to appropriate and effective efforts at change? By themselves, the previous seven lettered statements do not provide such a base for conceptual understanding. If, however, as the Associate Director remarked many times, "much has been learned", and if these learnings are appropriately and clearly included in the Project's own final summary of its activities, then a level of understanding may be developed from the Project's experience that could constitute a beginning in this regard. At this time, however, the basis for such conceptual understanding has not been developed in a way that could measurably aid others seeking to create model districts, schools or classrooms. The data that have been gathered have been neither rigorously assessed nor organized in a way which would allow them to be formally presented for review.

D. Recommendations

In the previous evaluative comment section of this report, three aspects of the Model District Program were analyzed; the organizational, operational, and social reality portions. Within each part, a series of questions were posed, and narrative answers given - answers that provided evidence of what was accomplished.

This section of the report offers recommendations summarizing the evaluative comments previously suggested. Recommendations to the Project will be of specific interest to the PCS staff, and the New York City School System, while those dealing more with policy are aimed at the broader community of science educators and the funding agency.

1. The Project should attempt to make better use of personnel within the New York City School District.

The New York City school system is staffed by some capable, highly sophisticated people. The system has, as one would expect, an inertia and a certain penchant for maintainance of procedures to which it has become accustomed. These drawbacks, however, are not by any means the sum total of what the system has to offer. If only the impediments are seen, then the sole approach conceived of will be how to minimize the blockages they represent. That would lead to a strategy of avoidance, i.e. the less contact with certain forces the greater the likelihood that the Project will attain its goals. We believe that something like that occured with PCS. It was not a sound strategy.

Several key individuals complained of lack of contact with the Project though they were willing to cooperate and even offer their services. Avoidance denies the Project the talents of such individuals on the presumption that the opposition they may offer will be thus mitigated. Indeed, the likelihood is that the key task of such a Project is to overcome precisely such opposition by confronting it with a better way of doing things. Both groups benefit from such direct interaction. The University is kept more alert, and its efforts more realistic because the superiority of its approach has to be demonstrated not assumed. The Public School representatives benefit from exposure to new ideas or approaches. Even when not totally convinced they may end up more open to allowing alternative approaches than they were previously. Confrontation can result in both sides modifying the initial rigidity of their positions, finding that each harbors some elements of reality. The Project's refusal to use these resources, however, assures non-cooperation.

2. The project staff should state more clearly the changes they are seeking to bring about.

Any attempt to introduce a change into schools involves some existing behavioral or programmatic regularity. The Project should be capable of stating these regularities that exist, and noting the changes in the regularities it intends to bring about.

Several recommendations appropriate to PCS can be developed from the paraphrased remarks of Sarason that form the basis for the above recommendations.

(a) Fund a planning period.

(b) Hire experts in the change process.

(c) Provide in-service training in the change process for staff, particularly reviewing the key literature that exists in the field.

(a) Fund a planning period

There was an obvious need for PCS to study and understand the school culture, to identify the existing regularities, and to state their own intended outcomes with respect to those regularities. Being in a service relationship to the school for the purpose of study and understanding - not training and change - would have allowed the development of a more scholarly approach to the dynamics involved in the Project. The present "Teacher Corps" funded planning period is a good example of what is meant.

(b) Hire experts in the change process

A dilemma is frequently developed by the attempt to create a working relationship between many institutions with different goals and different working relationships. Cooperation does not just happen. Management consultants and/or

trainers of group process skills are necessary personnel to be included in project activities right from the beginning.

The management consultant's responsibility is to alter people's perceptions and knowledge of each other's problems and to create the conditions for non-competitive, nutually satisfying, exchanges of information, plans, and resources. Group process skill improvement for all members of the project is necessary.

That "cooperation" was expected to be an important (and routine?) component of this grant and can be gauged from the two titles given to the Project. In the original proposal, it was called Project City Science: A Cooperative Investment in Quality Science for Intermediate Schools; in the proposal for refunding, it was called Project City Science: A Cooperative Multi-Functional Approach to the Improvement of Intermediate School Science Teaching in the Inner City.

Unfortunately, none of the different working arrangements designed by the Project staff to increase the cooperative nature of the undertaking - components such as self-study, task forces, workshops on techniques in science teaching, etc. was very successful. A more direct training program in group process skills may have been of aid. It is believed that the resources for such training were available within the University community.

(c) Plan in-service work for Project Staff, particularly reviewing the key literature of implementation and change efforts.

Many excellent summary papers designed to acquaint educators with the planned educational change field exists. One of the best, for example, was written by Joseph B. Ciacquinta, of New York University. Some remarks contained in his paper presented at the AERA annual meeting in March, 1978, are provocative:

> The fact is that most, if not all, implementation efforts fall short of their intended marks. But why do they?...Most school innovations require substantial resocialization (and not mere re-education) of existing personnel, implementation that is paralyzed in part by the lack of control we have over the required personality change process...

3. The Project should strive to meet the original goals of the Model District Program.

To accomplish this recommendation, these goals must generate an appropriately implemented program. "Appropriate implementation is not ideal implementation, but rather enactment to the point where the essential elements of the original innovation are left undistorted."

A previous report recommended the following necessary actions to carry out the original goals:

(a) The collection of data regarding the knowledge of science content and science processes from students who are just beginning involvement in a PCS class, as well as from students in non-PCS classes.

(b) The collection of similar data from students who have spent a year in PCS class as well as from those youngsters who were non-PCS students.

(c) The collection of data indicating, the knowledge of science content and procedures from PCS cooperating teachers and science teachers in the same schools who do not participate in the Project.

(d) In each PCS school, procedures should be initiated that reflect an active community involvement in PCS related activities.

The collection of such data would form the base upon which the Project could begin to measure the impact of its efforts upon participating students and teachers. Without such information it is unlikely that the PCS staff will ever have an accurate picture of where it is succeeding and where it is failing. The creation of model districts, schools, or classrooms cannot rest upon purely intuitive procedures. The Project needs the "eyes" of its research staff to determine where and in what ways its influence is being felt.

4. The Project should conduct its workshops in the school districts.

This was a common suggestion for improving the competence of the cooperating teachers. The Project has done this in the past, but gradually the workshops appear to have been relocated to the University. Such a tendancy is not unexpected, but would appear to defeat the purpose of the workshops by making them less available, in practical terms, to teachers.

Schools also cited as one of their needs a mechanisms for more effective communication among faculty members. PCS might consider this a topic for a special consortium of principals, assistant principals, and other district supervisory personnel. Surely it would be a topic of vital interest to all of them. Appropriate experts might be invited to facilitate such deliberations.

5. NSF should promote some programs whose express purpose is to identify success models in science education - especially as they exist in urban areas.

Success models identification, inventorying, verification, and the subsequent initiation of casual studies represent a critical need. Input of federal monies into these success models to assure their continuance and improve their performance seems to be a good investment. Such ongoing programs could become sources of study for one another, as well as for others interested in determining

what appears to work best. Offering such programs further support to expand or strengthen their efforts would thus serve a dual purpose.

Such a concept is quite different from that of funding a large scale effort that is outside of the system seeking to work its way in. Here, the premium would be upon funding existing programs which are performing successfully and have already learned something about how to function effectively within the structure of the schools. NSF could provide important support that would enable such programs to learn about one another, create a network that would exchange information, and make an objective analysis of the central causes of their success.

VII THE DISSEMINATION PROGRAM

A. Introduction

Considerable information about the PCS dissemination goals, tasks, and activities is presented in Appendices A and B to the full report. Dissemination is one of the four major components of the project, and is designed to transmit and communicate information about the model districts, research, and pre-service components to institutions in urban centers, as well as to other interested groups.

B. Purposes of the Dissemination Program

The goals of the dissemination component of PCS remained unchanged when the project made its request to be refunded. These goals were broadly stated as follows: "...to generate and disseminate knowledge about adolescents, the learning of science in the inner-city situation, and the process of improving science education."[39]

Through the brief history of Project City Science, dissemination has been considered a separate program, an aspect of the research program, a part of the effort to insitutionalize change or even an unnamed part of the Project's efforts. However, at all times the Project City Science staff has recognized the major role that the sharing of ideas through a variety of media must play in a project of this magnitude.

In the Goals, Tasks, and Activities section of the revised proposal the following clarification of the dissemination phase of PCS was presented:

> To extend the influence of the project beyond the boundaries of New York University and the participating districts. This goal (dissemination) can be achieved only if the project is reasonably successful in reaching its first five goals.*

*See Appendix P, p. 366.

The 1975 proposal to NSF offered an adjusted dissemination plan with the following new features:

1. The revised plan relies even more than before on engaging other universities in New York City in the enterprise....Efforts will be accelerated during Project Year #2 (1975-76) to inform the universities in the city having education departments of the project's work. Initial inquires indicate that at least three or four teacher training institutions and six to eight community colleges are ready informally to explore various possible ways to become associated with PCS.

2. A higher premium is placed on the project's being able to demonstrate substantive and unambiguous "success" in the district in which it works. Only then will other universities and districts be likely to make long-term commitments that are eventually needed to achieve city-wide dissemination.

3. This information-sharing responsibility will have to be tailored to contribute maximally to dissemination within New York City itself. To the extent that the project gets positive, tangible results and makes them known, teachers, administrators and parents will seek to emulate its approach. (Emphasis added.)

4. To the extent possible, the overflow (of teachers trained by PCS' preservice program) will be deployed in other districts in such a way that they eventually will be in a position to help in continuing dissemination activities.

5. Intermediate and junior high school teachers and administrators throughout the city need to be informed continuously of ways to improve science instruction in their schools.

As the Project learns of useful actions that any district or school can take to improve instruction with or without Project interaction, it intends immediately to spread the word. It also wants to let teachers and administrators outside the formally participating districts know of help available to them via Project City Science. Some of these might be: Documents and reports; visits to project schools with special science programs; teacher exchanges; "loan" of trained resource teachers to serve as special consultants; project help in conducting their own self-studies and in planning science activities; copies of New York City Field Trip and Resource Guide (to be prepared by the project); names of individuals in other universities who might be interested in cooperating with them in a PCS-like relationship; and attendance at PCS symposia.

> One method selected for disseminating information is the publication of an inexpensive monthly, called Citiscience Notes which will be sent by the project to all New York administrators and science teachers in the middle grades.
>
> ... (The participating districts will do an additional distribution within their boundaries, including to community groups. The Junior High School Principals' Association has agreed to send copies to all its members.) Another method of dissemination (for a different audience) will come from modifying the Quarterly Report* to include "signed articles" by staff members. The intent of these essays will be to present thoughtful reflections on staff experience, and they are to be written so as to be useful to colleagues having similar interests. Articles will also be solicited from teachers and administrators in the participating districts.[40]

C. Description of Activities:

The paramount concern shared by the PCS staff and leadership at the time of this report was obtaining funding for Project continuance. This gave the dissemination program a special importance in attempts to reach varied groups who might consider adopting the Project.

The PCS Associate Director identified the primary audiences for dissemination as:

1. School personnel (teachers, principals, supervisors).
2. Political influentials (union officials, central board officials, higher level personnel in educational agencies).
3. College-university personnel (science educators, professors of education, university administrators).
4. Professional educator groups (e.g., N.S.T.A., A.E.R.A., etc.).
5. Informal groups (community people, parents).

Special efforts have been made by staff to reach and interest the "political influentials" and "educational opinion leaders" in the educational

*As noted earlier, the Quarterly Report (now referred to as Progress Reports) is a triannually produced document reporting on Project activities.

bureacracy. This was done in hopes of persuading the leaders to join PCS in dissemination efforts and eventually have other New York City districts adopt PCS. The Project mainly relied on informal means to reach potential adopters. The Advisory Board was a key mechanism in this type of dissemination. The Board has not met, however, since September 1977. This seems unfortunate, since the potential for devising a formal plan for dissemination, as suggested in earlier sections of the full evaluation report, could have been a major Board agenda item.[41] The PCS staff does indicate that contact with individual Advisory Board Members was continued during the past year, and that these members often suggested ideas for assisting PCS dissemination and implementation.

Progress Reports:

Two additional Progess Reports have been distributed since the earlier evaluation reports.[42] No specific section labeled "dissemination" appeared in these editions as had been done in earlier Progress Reports, however, several references are found to dissemination efforts under the sub-topic "Continuance of Project City Science."[43] Here, conference presentations are cited, and note is made of contacts established at those conferences. Basically, Progress Reports #14 and #15 deal with Project implementation activities in the Pre-service, Research, and Model District programs.[44] In "Notes from the Director", a suggestion is made that new groups may be contacted (or present contacts expanded) with a broader dissemination audience in view:

> If the City is unable to provide financial support, we shall approach private foundations and various industries in the area.[45]

If PCS seeks to diffuse its achievements to private foundations and industry in the hopes of obtaining funding, it appears it will again have to rely mainly upon personal, informal contacts.

Citiscience Notes:

Four issues of Citiscience Notes were published since June, 1978. The designated audience was secondary teachers in New York City schools. These issues have a somewhat new focus according to the PCS Associate Director. Responding to a suggestion by the evaluation team to improve the "content" in Citiscience Notes, the later issues were adjusted to highlight unit work in curricular areas of astronomy, nutrition, and oceanography. The emphasis upon curricular topics would appear consistant with interests expressed by teachers. An additional Citiscience Notes is planned for the Fall, 1979, semester. It will deal with environmental science topics.

E. Conference Presentations:

A fundamental means for communicating PCS program design, research, and implementation successes is through the use of presentations at professional conferences. PCS reports that they have made presentations describing the project to several assemblies of educators last year. Presentations were made at AET, NSTA, and NARST conferences. The format for conference presentations generally included a special inquiry table so that interested science educators could secure materials or attend group presentations describing PCS activities provided for conference participants. Research presentations made at some of these conferences included completed doctoral studies by PCS staff.[46] To reach a broad audience, PCS has made a variety of group presentations, including the following:

1. NYU School of Education, Health, Nursing and Arts Professions Alumni meetings.

2. State Education Department Conferences.
3. American Federation of Teachers Consortium, 1978.
4. Local and regional meetings of principals, supervisors, and teachers on issues of the "middle school."

The primary purpose of group presentations was to establish a "linkage" between university educators, urban center teaching and administrative personnel. Evaluative comments will be presented on the perceived effectiveness of these activities later in this section of the report.

Other Dissemination Formats:

PCS has attempted to use a wide variety of formats to diffuse the innovation of a "hands-on" model. Mass-media efforts included the CBS TV presentation on NYU; Sunrise Semester, in March, 1979. The PCS Associate Director appeared as a panelist discussing "Reading Problems and Science Classes." The early hour of this programming (6:30-7:30 A.M.) may have restricted its impact on the wide audience, but nonetheless the Project's ability to obtain such exposure is to be commended. No follow-up data on the effect of this TV presentation (in terms of the number of inquiries generated etc.) was collected by the PCS staff. Such efforts, however, must be considered a very positive means of communicating the Project to a large audience.

Printed materials and publications, other than the Progress Reports and Citiscience Notes, include Project recruitment advertisements sent out from the Division of Personnel office at the New York City Central Board of Education, general references (one or two paragraphs) to the Project's work and activities in Middle School Musings (a publication of the American Federation of Teachers' Educational Issues Department), and mention in the Dean's Report section of the New York University Education Quarterly, 1976-1978. Intra-district dissemination

materials often receive priority, with the Project using school newsletters to publicize their efforts in Districts 10 and 17.

Two formats were omitted, however, which, in the opinion of the evaluation team, could have served as strong dissemination mechanisms. One of those was the failure to use the Educational Resources Information Clearinghouse (ERIC). The other was lack of any attempt at formal articulation with science department chairpersons at high schools receiving students from the junior high and intermediate schools used by PCS in Districts 10 and 17.

A comprehensive search for articles, or research reports, about PCS in ERIC documents located only one article available under the descriptors Urban Education, Science Education, Curriculum, Junior High Schools, Secondary Education and Science Programs. This article was "Science for Urban Junior Highs" in Mosaic magazine, a publication of the National Science Foundation.

PCS staff explained this lack by pointing out that a definite "time lag" exists between completion of research projects and published reports in ERIC. It was felt by staff that Project research is just getting underway this year, thus the dearth of ERIC listings. Since ERIC serves as such a valuable information retrieval facility in education, however, it behooves PCS to make effective use of it. It would have served the Project well had a more calculated effort been made to have themselves included in the ERIC listing. Although PCS is an intermediate school program, planned articulation with high schools is an important element for dissemination. A brief survey was conducted of high school science chairpersons and assistant principals in feeder schools from Districts 10 and 17.[47] Forty-five chairpersons were surveyed, and of the fourteen who responded, none indicated that he or she had heard of PCS, yet each of these schools had students who had been through the PCS experience. This lack of

recognition should be addressed, and efforts made to inform guidance counselors, high school science teachers, and chairpersons about the purposes and goals of the Project as it attempts to improve science teaching in city schools. The survey of chairpersons also indicated that 11 of the 14 chairpersons "feel that Citiscience Notes are of sufficient interest and value to secondary science teachers to have the department receive them in the future", though they were not currently receiving the publications as of May, 1979.

PCS Staff Assessment Outcomes:

In an attempt to have the Project speak for itself, interviews with Project Staff were conducted over the past few months (1979). What follows is a PCS staff assessment of where they believe they are, and what they feel has been accomplished.

Below are the major goals of the Project, stated by PCS staff as intended outcomes, and used by them to assess the effectiveness of the Dissemination Program:

1. Continuance of the Project in currently participating in New York City Districts
2. Expansion of the Project to other New York City Districts
3. Establishment of parallel Project operations in other cities
4. Attracting preservice teachers to the Project
5. Explaining the purposes of the Project to teachers in New York City and other urban centers
6. Gaining commitment from groups such as the UFT, school administrator organizations, and New York University
7. Sharing research findings at professional educational conferences
8. Making the science education community and university teaching personnel aware of the Project's work

9. Reaching community members and parents of school children to inform them about the Project
10. Sharing information with teachers and administrators in urban centers that will revitalize science education efforts at the junior high and intermediate school levels

The methods used in dispersal of Project information, and those noted by PCS staff as examples of their efforts included:

1. Mailing or distribution of printed materials and documents such as Progess Reports, Citiscience Notes, project articles, and project advertisements
2. Group presentations, such as those made at conferences and elsewhere
3. Informal personal contacts

The main target groups for receiving information were: school personnel, political influentials, college-university personnel, professional educators groups and informal group in the community. Highest priority was, of course, given to the New York City groups in all categories mentioned. The individual school building was identified as the key unit for the diffusion of innovation and development of Project "identity."

Other communication networks identified by the Project staff as being important in the natural diffusion of the innovation were:

1. Use of interns, cooperating teachers, and students, to reach parents and involve them in PCS projects (e.g. speaking on careers and job opportunities in science and technology)
2. Use of the implementation course, and other NYU courses to familiarize interns with the community, and hopefully motivate interns to become more involved there

3. On-going communication with building principals and district teachers.

Recent accomplishments identified by the Project staff in interviews with evaluation team members were:

1. Letters received from 20 New York City districts reporting interest in implementing a PCS model
2. Interest expressed by teachers' union representatives in having PCS become involved in newly formed Teacher Centers in New York.
3. An offer to have PCS staff involved in some stage of junior high science curriculum revision being undertaken by New York City science supervisors and directors
4. Liaison with science coordinators at the State Education Department.
5. New York City's Central Board's inclusion of PCS recruitment materials in their mailings
6. Several persons at the Central Board expressing positive feelings about the progress of PCS, including an ex-superintendent of a New York City district that sponsored PCS in the past

The project leadership felt, and strongly emphasized, that a maximum professional effort was being made by all staff members. They noted that each individual staff member was motivated, competent, and interested in the job he or she was undertaking. In the words of the Associate Director, "Not too much more could have been done" (to reach effective dissemination levels).

A dedication to field work was expressed by many staff members, and they strongly voiced their approval of a "grass roots" communication of the program which would be accomplished by working cooperatively with teachers, supervisors, and administrators in each of the Project's buildings.

A protest against overlooking the "obstacles and realities" facing this innovative project was registered by several PCS staff members in regard to

former evaluation reports. Project staff felt that the barriers to implementation and dissemination of their efforts were being neglected in the analysis and evaluation of the Project components. They expressed the opinion that the evaluation report had oversimplified the difficulties of initiating and implementing a Project with complex elements of pre-service training, research, model district development, and dissemination.*

Among the obstacles listed by the staff members were:

1. Situational factors:

   Early closing of schools, questionable safety for after-school hour seminars, inadequate physical plant and space facilities, discipline problems, vandalisms, shortage or destruction of materials, and an inconsistent curriculum

2. Personnel constraints:

   Turnover of teachers, effects of the 1976 strike, uncooperative teacher attitudes, attitudes of resistance to change, inexperienced staff and supervisors, and uncooperative custodial staff

3. Financial constraints:

   Insufficient monies for materials, inability to employ additional staff when needed, New York City's fiscal crisis of 1976

The evaluators recognize that there are numerous obstacles to success. Project City Science is a complex interaction of children, administrators, teachers and university personnel. Each of the professionally responsible groups is seeking, in its own way, to improve teaching and learning in the City's junior high schools. The tasks PCS has set for itself-preparing careers in teaching, developing and testing instructional models, generating research - are indeed laudable.

*It should be noted that from the perspective of the evaluators, this represents an interesting reversal of positions. It was our view, rather strongly expressed, that the Project had indeed selected an excessively ambitious set of tasks and would experience extreme difficulty attempting to implement them.

It is natural to expect that there will be many instances where these tasks will appear contradictory, and the goals conflict-producing. If one pauses to consider the small staff, the size of the task, and natural limits on human energy and time, it is reasonable to conclude that the Project staff were, and perhaps had to be, dedicated and idealistic. Jointly, this small group attempted to tackle head-on the inertia of a system known for its complexity, varied problems, resistance to change, and immense size. This should be part of anyone's understanding when the accomplishments of the Project are assessed. On the other hand, these are precisely the problems PCS chose to address, and that should be part of the Project staff's understanding as well.

As an expression of ideal professional goals, PCS cannot be denied. Unfortunately, this Herculean effort cannot be evaluated solely on the worthiness of its aims. There must be a realistic preface to disseminating innovations that includes careful assessment of what is to be attempted, what resources will be available, what others who have made the attempt have learned, and what realistically can be expected from interaction between a project and the "real world." The dissemination effort, because it was a sub-function of the other Project components, has been dependent upon them for reportable results. The fact that in a number of instances (particularly the Model Districts and Research Programs) such results were not forthcoming, in itself represented an important obstacle to the dissemination of data that could reduce resistance and invite replication.

E. Overall Assessment

1. Absence of a Plan:

In the view of the evaluators, a major flaw in the dissemination effort has been the lack of a clear, consistently used, and well-designed strategy or plan. The Staff appeared to depend upon three major dissemination vehicles: Citiscience Notes, the Progress Reports, and presentations at major conferences. As a complete plan for reaching the large and diverse audiences the Project was intended to serve, this seemed unimaginative and unnecessarily limited. What was missing was an operational mechanism for recognizing and dealing with the differing needs, interests and levels of the audience served. If this was not possible, then a clear plan should have been developed for limiting the scope of the audience, or for using available dissemination resources more efficiently.

The evaluation team raised the question of how the objective of disseminating Project results can be accomplished effectively without a formal plan. The Project did not answer this question completely, and, to this date, no formal plan exists. What the Project staff offered was a set of informal strategies and tactics designed to reach opinion leaders, educational leaders, and others. This set of strategies emerged from the experiences of the Project and is partially traceable to an earlier version of a diffusion model described in a 1975 Progress Report*. As was true of the overall dissemination effort, the scope of these activities appeared too narrow and their form too limited to attain the ends sought.

*For a discussion and analysis of the dissemination model, and a detailed account of the strategies and tactics used by PCS see Appendix R.

2. Strengths and Weaknesses in the Project Dissemination Formats

PCS dissemination was most successful at two levels of communication: Creation of interest among select audiences, and the creation of awareness among select audiences. Far less success was observed or recorded at the levels of trial adoption by other school districts or universities.[48]

The heavy reliance on Citiscience Notes and Progress Report as the major dissemination vehicles was hampered by the lack of a systematic reporting system that would have enabled a two-way communication network to develop between the readers and the Project staff. Little in the form of reader reaction was systematically collected over the Project's duration. Exceptions to this were an occasional reader survey, and a few letters of interest from individual readers.

The Progress Reports recount the most important Project work and research during the five years of Project activity. However, in the opinion of the evaluation team, this publication often contained information of limited use to the reader audience, particularly when it focused on the mechanics of the Project. In fairness to the PCS staff, it should be noted that a recent survey of Citiscience Notes and Progress Report readers (1979)indicated a positive reaction,* though the returns from the reader survey are small (a response of less than five per cent), and therefore not statistically trustworthy. Those responding express satisfaction with the content of the Progress Reports and indicate that they read the publication regularly and deem it helpful. As with the Progress Reports, the questionnaire return for Citiscience Notes was very small.

*See Appendix Q, Results of Data Collection, Progress Reports and Citiscience Notes Reader Survey, 1979.

Although Citiscience Notes are designed for classroom teachers, and reach a limited audience, they have created awareness of and interest in the Project among readers. The strengths of this publication are that it can act as an instructional device, it is free, and the content offered is practical. Teachers can pick and choose the ideas they want to use on a given topic. Some issues can be used directly by the children, and the listing of free resources is valuable-especially to new teachers. Some of the criticisms offered by the reader audience included concern that the content was too easy for the junior high school level, and that it was not consistent with the curriculum already established in the districts.

The part played by professional conferences in dissemination was cited by PCS staff several times. With the exception of certain presentations of completed doctoral studies, most PCS efforts focused on familiarizing audiences with PCS pre-service intern training activities. An outside consultant's report on a presentation at the National Science Teachers Association Conference in April, 1979, stated:

> The presentation by the NYU representatives did go into fair detail about pre-service training of interns at the University. However, there was a lack of detail about numbers of interns who had come through the program and their subsequent roles in helping to solve the serious problems of junior-high science education in urban areas.
> Apparently, there has not been an effort to make quantitative assessment of the affective or cognitive change among junior-high students subjected to NYU student-clinical professor instructional program. Nor were any data presented on change in the cooperating teachers or school administration as a result of NYU presence.[49]

Thus, although the PCS presentations could spur interest and general awareness, they certainly could not assist possible adopters of the Project to evaluate or trial-adopt without presenting hard data on results and outcomes.

In summary, only one New York City school district other than Districts 10 and 17 has trial-adopted some of the PCS work, and that is District 15. This has not yet become a full commitment to the Project on the part of the District. PCS leadership feels that District 15 is likely to be a serious adopter of the Project in the future, and represents an important example of the Project's successful use of dissemination techniques. As of July, 1979, however, it is not clear that any school district, including the two the Project has worked with for the past three years, has made a commitment to continue in the program next year.

3. Reviewing the Literature on Change:

The evaluators wish to note that the suggestions offered in this section are not intended to imply that the Project should have used any one of the specific recommendations from the research studies that will be cited or referred to. It is understood that a number of different approaches to implementing change are available, and that no single one recommends itself as a clear-cut and necessary choice. What is suggested is that a large body of research literature encompassing past innovation exists. It is believed that the experience of others with change can be profitably consulted. Thus, this literature could serve as a reservoir of ideas and concepts that could inform such projects about the change process in organizations. This is especially true if and when there is a turnover of Project staff, and there is a need for new team members to become familiar with the strategies of change as they are represented in a change paradigm. It would be naive to imply that there is a distinct body of theory which would guarantee success for an innovation. But the evaluation team does feel that sufficient research has been reported that can give innovative efforts a basis for effective planning of dissemination and dissemination efforts.

Noteworthy among the studies are the Ford Foundation effort,[11] Brickell's research on innovation in New York,[12] Seymour Sarason on change and the culture of schools,[13] and the Rand Study of federal programs.[14] Such studies examine initiation, implementation, and incorporation stages of innovation and can serve as guidelines for projects.

It is suggested here that a thorough familiarization with theories of change and application of concepts helps an innovative project attain success. If the steps required to initiate and implement innovations are left to less experienced change agents rather than to those who have the skills needed to help teachers employ new approaches, the chances of success are greatly decreased. PCS is a university-based program. In the division of which the School of Education is a part, there are knowledgeable faculty with specialties in organizational change processes. Surely their expertise could have been used on at least a limited basis to aid the Project's development. It would seem that the effort to use expert help, or to organize a more formal effort at expecting change was not as extensive as it could or should have been.

PCS has been in existence for five years. Certain phenomena associated with prolonged innovative efforts including teacher "burn-out", project decay,[15] loss of the novelty of the innovation, and attrition of key personnel all needed to be faced. If these phenomena are ignored over long periods, they become an instrument for eventual deterioration of the innovator's energy and effort. The Project was insufficiently aware of these dangers, taking little notice of them and thereby profiting very little from the experience of others.

4. University Support and Innovative Diffusion:

In the opinion of the evaluation team, the use of an institutional change model and the involvement of an experienced change specialist would have helped the Project to develop more precise functional and adaptive goals over its five year funding period.

Based on interview data and observation in the schools, it was apparent that conflicts of view arose between on-site coordinators and cooperating teachers. These conflicts surrounded the issues of school norms (e.g., traditional methods vs. hands-on). Under these circumstances, change came slowly, if at all. A clearer delineation of the role of the change agents (on-site coordinators), combined with an in-depth knowledge of change processes and supervisory techniques, would have made a significant difference.

There is a possibility that a group of concerned NYU Faculty may be on the verge of forming a group called the Metropolitan Center for Educational Research and Development. Formation of this group began in a May meeting at NYU.[55] At a colloquium on change, faculty papers dealing with educational change were presented. A major outcome of this meeting was the discussion of the establishment of the Metropolitan Center, which would include membership from PCS and Teacher Corps, as well as faculty with a specialization in educational change processes. There is an opportunity here to build in a support for field projects that could blend research efforts with practitioner interests. That the Project did not itself foster such inter-departmental colloquia earlier seems unfortunate.

F. Recommendations

1. The dissemination effort must move to the level of describing research and offering data about the results of its training model.

To be an effective long-range voice for science education in urban centers, PCS must design a dissemination plan that goes well beyond sharing information which only describes activities and goals. Up to this time much of the dissemination phase has dealt with recruitment of students, publicity to districts, and program information to other cities and institutions of higher education. After five years the Project should begin to show results, negative or positive, so that other innovative science education efforts can replicate the PCS model. A serious lack of reporting mechanisms and lack of feedback data on PCS drop-outs, its graduates, and its experimental schools, hinders the dissemination of the model to other areas of New York City.

It is unrealistic to expect a small group like PCS to be the spokesperson for science education at the junior high school level, especially in the light of the enormous educational, economic, political, and social problems faced by New York City in the 1970's. But the Project can center its efforts on reporting useful information gained from its experience in two districts. This will mean renewed Project energy will have to be expended by the staff in conducting research efforts, making presentations at conferences, and collecting data for dissemination. In order for any district in New York City to replicate the Project, a great deal more information about results need to be forthcoming.

It would seem generally speaking, that the PCS Staff has only reported limited research findings in their Project work thus far. The evaluation team has been informed by the Project Staff that the designs for research and collecting data are just taking shape. This was but one indication that the Project was having difficulty meeting the original timelines for research set in the PCS proposal, a fact that does not bode well for replication of PCS by other university groups at this time.

2. The Project staff need to reconsider and clarify their choice of an educational change model.

Project personnel need to more precisely determine what concept of educational change they believe in and want to use for the remainder of the Project's existence. It is also recommended that PCS consult with outside change specialists with the intent of setting clear directions for future dissemination activities. The sine qua non for effective dissemination is effective project implementation. The PCS endeavor has focused on the operation of an innovative classroom instructional model, the establishment of model districts, and the production of science education research. All of these efforts require a carefully conceptualized model for changing teacher and student attitudes in these experimental schools. They also mandate that the change specialists be able to coordinate and supervise many facets of the Project under difficult circumstances. Certainly the evidence thus far indicates that the Project would benefit from supplementary help given to the on-site coordinators in addition to the support they received from university staff.* This help might come in the form of special seminars, conferences, or course work for on-site coordinators on the topics of organizational change.

*See Appendix E in which interviews with coordinators are reported.

If the Project chooses to continue using the present position of on-site coordinator as the major role for implementing PCS models then sufficient time must be allocated for the on-site coordinator to become more knowledgeable about the complexities of the change process in urban junior high school environments. If time is allocated for coordinators to meet with change specialists and reflect on the demands and responsibilities of the position of coordinator, a series of useful plans could be developed. Such an attempt, if successful, would also require building principals and assistant principals to participate in a team effort.

This recommendation will be easier to implement if the Metropolitan Center for Educational Research becomes a reality at NYU. Even if it does not however, the Project should make every effort to improve its training of coordinators.

3. Dissemination must be made in format that insures fidelity to the PCS model.

The PCS struggle to maintain the Project and to establish new funding sources may increase the danger that there will be further loss of Project identity. Any precipitous or dramatic changes in the form and substance of the Project could leave only a skeleton of what was intended or accomplished. If the Project Staff truly feels that it has a solid pre-service model and that they can shape model districts or initiate valuable field studies, then they must not stray too far from the original model. If the staff manipulates and recasts the role of on-site coordinators by selecting them in ways that fit individual school districts but not those of the Project, PCS may end up with just another student teacher program. The Project has been bordering on just such a danger for the past two years. There are times when it does appear that PCS is but a slight variation on a theme generally used by colleges to prepare pre-service teachers. However, the Project does contain some special features, and these features are noted by cooperating teachers and administrators in the schools.

For example, during interviews with building principals and assistant principals it was pointed out on several occasions that PCS, unlike traditional student teacher programs, was "unique to their schools because the interns remain longer at a building site and have more input in selecting the building in which they wish to student intern." Certainly these are two examples of features that PCS should insist remain intact.

If the PCS staff will reassess their present status and try to set clear standards and directions for each of the major program components, they might still shape an effort that could, in some small way, improve science education in urban junior high schools.

4. The Project should attempt to define its intended audience more clearly.

The PCS staff must consider whether or not the evidence of implementation results over five years supports the assumption that the Project has equally positive advantages for all urban junior high schools. This recommendation is intended to suggest that a definite limitation of the audience targeted for PCS dissemination be considered.

As commented upon earlier in this report, PCS staff has spread its efforts thin and aimed its dissemination tactics at multiple audiences ranging from university people to school teachers in urban centers. In a way, it has attempted to be all things to all people when it came to improving urban junior high school science teaching and preparation of teachers for the classroom. It is a naive assumption, in the opinion of the evaluation team, that any one innovation can be disseminated to such diverse audiences with any significant success. It is recommended that the target groups in the future be limited to very small samples of junior high school personnel in New York, and to only a few select, and interested urban universities. The results of one survey found

that very few graduate teacher education divisions (7 out of 24 surveyed) had more than a superficial knowledge of PCS. None of the 24 schools anticipated using a training model similar to PCS for preparing pre-service teachers.[56]

5. PCS should continue to draw upon the support of influencial educational leaders to disseminate its ideas.

The evaluators recognize that political factors often play a significant role in project continuance in large cities. The Advisory Board should be maintained with this in mind. PCS, through its Advisory Board membership, was able to speak to a very special dissemination audience. The political dimension of the dissemination of innovation is nearly as important to adoption as any other dimension. A renewed attempt to work closely with the Advisory Board Members is important to any future PCS may have in New York Schools. The Advisory Board supplies the needed symbolic and political status for the Project in this City.

Questionnaires returned by Board Members generally indicated a mixed reaction to their involvement but were positive in their overall reaction to the Project efforts.

*For summary of Advisory Board Survey, Spring 1979, see Appendix Q, Results of Data Collection.

VIII THE RESEARCH PROGRAM

A. Description of Purpose

When the budget for the second phase of Project City Science was revised downward, the scope of the research program was also reduced. The following four broad goals are spelled out in the revised proposal as constituting the major intent of the Project in this area.

1. A Research and Evaluation Institute

> The intent is to design a lasting mechanism that will begin to make headway in generating systematic knowledge about the science learning of early adolescents in the inner-city situation, and also how to achieve science teaching in the inner-city schools.[58]
>
> This mechanism was to have been named the "Institute for the Study of Inner-City Science Instruction," and would develop a "research model" rather than conducting basic research.

2. A Basic Investigations Program which would develop a "research model" rather than conducting basic research.

3. A Research Applications Program

> This would have included the identification of key questions necessary for the improvement of science teaching in the inner-city intermediate schools, determining the state of present knowledge and matching that to the key questions, and then identified the most useful research approach, and conducted studies suggested by this process.

4. A Program Evaluation Program

> This goal envisioned summative evaluations of various components of the program, disseminating the approaches used in these evaluations, and the institutionalization of these skills in the proposed Research Institute.[59]

These goals, taken together, form a composite picture of the research program. The program should be intensively involved in defining areas of need, and proposal models and approaches, conducting applied research and evaluation studies and disseminating the results of these efforts and organizing these activities into a functioning research institute.

A number of activities leading to the organization of a more formal research effort were conducted prior to 1976. These are reported on at greater length in the section reporting on research in Appendix A. For the purpose of the present evaluation, emphasis will be placed on the re-funded phase of the Project's operation (1976-79). The best description of PCS intent for this period is offered in Progress Report #8, issued in August, 1976. This report presented the most ambitious statement to date of research objectives and proposed activities. Seven lines of Research are suggested:

1. Science Knowledge of Inner City Adolescents
2. Science Attitudes of Inner City Adolescents
3. Science Learning Among Inner City Adolescents
4. Science Teacher/Science Student Interaction
5. Non-teacher influences on the quality of science learning and attitudes
6. Evaluation of pre-service program
7. Evaluation of "Model Districts" Program [60]

As of the Summer of 1978, while some work had been conducted on these lines of research, there had been no comprehensive attack on any one of them.

The purposes of the research program were outlined. At this time the Project viewed research as helping to improve the practice of teaching science to adolescents in the inner city. Vehicles for this included "technical" studies which would particularly focus on measurements of attitudes and learning.

A research approach was proposed which provided "paired complementary studies". Such an approach would have entailed two separate methodological analyses of a particular issue. Case studies would be paired with a survey, or a psychometric with a clinical or observational study, etc.

After some discussion of cautions, which must be exercised in conducting studies, the report offers a list of tasks to be completed for the Pre-service

Program, the Model Districts Program, and for the other areas of the research domain.

This quarterly report gave the most complete and detailed description of the research program. For the most part, however, it remained far removed from the specifics of actually designing and conducting research. No designs are presented, no analyses proposed, none of the usual requirements of research proposals are met. The report seemed to skirt or delay deciding exactly what could be done in PCS. The forty pages used to discuss the research program do not contain the explicit information needed to decide on whether PCS could in fact improve the practice of teaching science to inner-city students.

B. Review of Earlier Findings

At the conclusion of the Project's fourth year of operation (the second year of its re-funded existence), the evaluators reported that there had been no published or completed research documents that could be examined.* At that time, several studies had been recently inaugurated, and a number of statistical comparisons, such as changes in test scores as measured over a period of time had been done. At that time the evaluators offered the following tentative conclusions:

1. The studies in progress are not evaluative, but descriptive.
2. There are no ever-riding hypotheses or broad research questions which are guiding these efforts.
3. The topics have little to do with the hands-on approaches espoused by the Project.

It was concluded that while the studies could eventually lead to evaluations of the major components of the program, it would require that program expectations or objectives for each of these components would have to be more clearly stated. No such expectations had appeared in the progress report, or other documentation submitted to the evaluators up to that time.

*See Appendix A, Research Program.

C. Update of Recent Project Activities

The research and evaluation activities conducted during the 1978-79 year were primarily concerned with two major topics. The first was an analysis of factors which influence student achievement in junior high school, and the second was a description and analysis of factors in students' science career expectations and preferences. These two studies are presently being combined, in order to analyze the role of other situation-specific variables in the prediction of science career expectations and preferences. This third major thrust is not likely to be completed during this school year.

Much of the present year's efforts were based on initiatives begun during the 1977-1978 year. Many of the instruments were developed earlier, or were pretested on smaller samples during the previous year. Some of the earlier evaluations and descriptive studies, such as the Self Assessment In Science data, are being updated by other Project staff.

In addition to these data-based research projects, the staff prepared two related research proposals which would have enabled the staff to pursue its interests in the career-development processes of women and minorities. The staff also presented their findings to several conferences held during this period. One study which would have measured the extent of the use of hands-on methodology was disbanded after a short tryout. This involved use of a measure that was called Progress Index. It apparently did not yield data that the PCS staff regarded as useful.

In one of the Project's major research thrusts, a sample of 328 eighth grade students in inner-city schools was administered a battery of tests

which included a staff-developed motivational measure called the Need For Academic Competence, The Peabody Picture Vocabulary Test, The Brookover Self-Concept of Ability, and The Rozenzweig's Self Esteem Scale. A composite measure of grades and tests was used as a criterion variable.

Using a combination of regression and commonality analysis on a matrix of partial correlations, (verbal ability was partialed out), the investigation concluded that both motivation and academic self-concept variables separately affect academic achievement, and must be considered if attempts are to be made at improvement. Specific suggestions were made in regard to differential treatment of male and female students.

In the second major study, the battery of tests, which included those mentioned above, plus separate measures of mathematics and science achievement and a measure of the likelihood of entering science, were collected from a similar eighth grade sample. Methodologies employed in the first study were used to separate out unique variances attributable to each variable and/or combination of them. The overall predictability of science career expectations was somewhat less than that of overall achievement. This was probably due to the differential reliability of the criterion, and also because the motivation factor exerted a major non-intellectual influence.

Data collection, which included a measure of locus of control, The Intellectual Achievement Responsibility Scale, and an academic self-concept in science were completed during Spring, 1979. When the results are in, they should expand the possibilities for explanation and prediction.

D. PCS Staff Assessment of Research Outcomes

The research staff feel that they made several contributions to the Project during the three-year period of its re-funded existence:

1. In their internal evaluation, they were able to discover certain perceptions and attitudes of pre-science interns which lead to modifications of both the Integrated Science and Psychology courses. They discovered that a number of interns expressed dissatisfaction with various aspects of the Integrated Science course. Eventually, an Urban Ecology sequence was developed.

2. Their field interviewing assisted them in choosing certain variables, such as the self-concept for further analysis and provided a focus on various topics. The Research program included a set of research files on various topics.

3. The staff's interviewing also helped to decide which districts held educational philosophies which were conductive to good relationships.

4. Their regression studies are regarded as being an initial attempt to "map the affective domain." They also feel that these studies clearly indicate the need to individualize the curriculum, with females having their learning reinforced in ways different from males. The staff feels that this research is groundbreaking, and represents a fundamental contribution to the literature of learning. They feel that this is particularly true of their emphasis on situation-specific personality variables.

5. The addition of locus of control to the psychological conceptions already investigated is viewed by the staff as a strengthening of their research effort.

The decisions which led to these research and evaluation topics primarily rested with the research staff. Although goals and projections for a more comprehensive research effort are scattered throughout their proposals and progress reports, the staff clearly indicated that they began their efforts without much direction and without much assistance from other PCS senior staff. These conditions arose from several sources:

1. During an early stage of the project, the senior research consultant was on sabbatical.

2. The research assistants who were hired at the beginning had multiple assignments and could not delegate all their efforts to research.

3. Until the third year, the research staff was not comprised of any doctoral level researchers.

4. The Project director was not able to give as much time to research supervision as the staff felt was needed.

5. The on-site coordinators were generally not research-oriented, and could contribute little to defining areas in which research and evaluation could be conducted.

While these conditions were viewed as limiting, the research staff felt that once rapport had been established in the participating districts, the studies which were completed were a valuable addition to the Project and to the literature of science education.

E. Evaluative Comments on Research and Evaluation

There are two main sources which articulate the goals of PCS in regard to research and evaluation. The first is in the revised Project proposal:

> Research and Evaluation
>
> The third product will be an intensified, articulated, and on-going research and evaluation enterprise. Since the Project, taken as a whole, will not be as extensive as originally contemplated, it becomes more important than before to plan for the dissemination of knowledge. The intent is to design a lasting mechanism that will begin to make headway in generating systematic knowledge about the science learning of early adolescents in the inner-city situation, and also about how to achieve science teaching in the inner-city schools.
>
> To this end, we now plan to have in operation by the end of academic year 1978-79 what we are for the moment referring to as the Institute for the Study of Inner-City Science Instruction. We hope to have this survive as an NYU activity for at least 15 years. Its purpose will be to provide a place and a focus for research related to the title of the institute. The functions will include: Serving as a clearinghouse for research on inner-city intermediate school science teaching; identifying and promulgating related research needs; providing a location on a focus for post-doctoral and doctoral study; undertaking continual synthesis of accumulating knowledge; making possible longitudinal and group studies on important questions; and disseminating information on a continuing basis. The institute will also capitalize on the experience the Project has gained in assessing its own programs by developing an evaluation capacity to be put at the service of other organizations throughout the country that are working on the improvement of science teaching. This may eventually help broaden the financial base needed to sustain the model district/teacher training/research/change enterprise.[61]

The second source is Progress Report #8, wherein the seven lines of research noted earlier are presented as a framework for research and evaluation during the last three years of the Project.

The evaluators examined documents produced by Project Staff, interviewed members of the research team, and attended some of the meetings at which the research and evaluation aspects of the program were presented and discussed. These sources of information led to the following judgments about what was accomplished by the Project.

1. The research staff provided information about selected personality and cognitive influences on student achievement.
2. They provided information on the existing science career plans of some inner-city students.
3. Information was collected and shared with the rest of the PCS staff on the perceptions of scientists by eighth-grade students.
4. The evaluations of the Pre-service Program gave the Project some formative feedback on pre-service student coursework which led to modifications of the Project's curriculum.
5. A network of relationships was developed in participating districts which could assist further data gathering and evaluation.

Among the goals which were not accomplished with respect to the stated objectives are the following:

1. There is no functioning research institute.
2. There is no information on normative levels of science knowledge of inner-city students nor information on how those levels changed during the course of the Project.
3. There is no information on how students acquire the attitudes they hold toward science or science education.
4. There is no data on the usefulness of "hands-on" learning as an instructional model.
5. There were no formalized studies of student-teacher interaction.

6. There were no evaluations of the Model Districts phase of the program.*

Thus, the Project investigated, in some detail, four of the topics listed in Progress Report #8. Whether the results which were attained can be considered sufficient depends upon how much more the situation in which the Project operated permitted to be done. It is the belief of the evaluators that, in this case, there was the potential to accomplish more than was actually accomplished. What was projected was a five year period in which the staff would be able to mount its own efforts, attract additional help, and make some of its findings known. What resulted fell far short of what would seem to have been possible in such a period-even allowing for the difficulties. It is the belief of the evaluators that the research staff did not fully investigate the most important issues facing the Project, nor skillfully capitalize upon the opportunities presented. The Project staff could have delegated some of its efforts. They might have pursued more vigorously cooperation such as that offered from the Central Board of Education's Bureau of Educational Research, and investigated more intensively the impact of PCS upon the districts in which they operated. This at least would have informed the Project staff in a more objective manner as to how well it was accomplishing that which was being attempted. By allowing much of this information to be gathered by an outside evaluation team, feedback was not as immediate nor as comprehensive as was necessary for internal Project purposes.

Had basic research in science education, rather than internal evaluation been emphasized, studies could have centered more clearly on the main goals of the Project. There were no experiments performed during the course of the Project, and even questions as fundamental as whether students liked science classes more or learned more science when a hands-on mode was employed, remain unanswered. The evaluators concur with the perceptions of Project personnel that they were

*The Project staff notes that evaluations of the performance of on-site coordinators were conducted.

understaffed and not entirely prepared for the rather ambitious objectives established early in the Project's history. It does not concur with the PCS staff's view that the research which was conducted was unique or groundbreaking. Much went into the research effort, but the findings were neither incorporated into the Project nor could they have been, since they were not well coordinated with its activities. The teacher training, school intervention, and research evaluation elements each simply went its own way.

The research and evaluation program was not conducted in a manner that would enhance the Project, because the efforts of the research staff were not so directed or supervised. Instead, the efforts seemed calculated more to satisfy the research training requirements of the Project's research assistants. Without the planning which would have been necessary to make the research and evaluation applicable to overall Project goals, this was not an unexpected result.

F. Summary Assessment

The accomplishments of the research and evaluation component did not greatly enhance the overall effectiveness of this Project. The activities engaged in, and the visible products of these activities were only peripherally related to the stated intent of the funding proposals, and for the most part cannot be judged to be useful in any broad sense. The evaluators have attempted to focus upon the kind of research which could have been done to contribute significantly to the Project and increase its likelihood of success. The following types of research and evaluation activities appeared possible in this setting:

1) <u>Reviews of literature which examined how junior high students learn science, and extrapolations of these findings to the settings available to Project City Science</u>

The evaluators did not find such comprehensive reviews, although the literature in overall motivation and self-conceptualization was reviewed

quite thoroughly. No broad generalizations which might have shaped the instructional process were developed, and reviews, when done, were tailored for the type of study which was being pursued rather than for the overall utility of the Project. This appeared indicative of the Project's tendency, in the absence of an identifiable research design and adequate supervision, to allow the interests or strengths of individual staff members to supercede the needs of the Project.

2) Ongoing formative evaluations of specific Project activities

After a careful reading of the literature produced by Project staff, it is not clear which activities were most effective, what overall achievement results were obtained in Project schools, how successful the recruiting efforts were, and whether the hands-on technique was superior to other modalities. Given the particular talents and capabilities of the research staff, an emphasis on formative evaluation could have resulted in a significant contribution. It would have ensured a closer cooperation between the clinical and research staffs, because the relevant evaluation questions would almost necessarily have had to evolve from discussions between these personnel. Some efforts were made in this direction.

Pre and post testing of pre-service personnel for changes in science knowledge and other variables were conducted. Yet these data do not sufficiently exhibit the type of information on which program modifications could occur, nor were they extensively used in this fashion. Tests were

administered, and statistical results were computed, but the findings did not appear to be employed. It is unclear why the data was not more fully used. Perhaps they were not found useful for program evaluation. Part of that seemed due to the fact that the purpose for collecting such data was not always clear.

In either event, nothing very productive resulted from the considerable investments in both time and effort that went into the extensive testing of interns.

3) Research in consultation and cooperation with other members of the science education community

One method which this Project could have used to expand its network of relationships was to invite researchers, either local or national, to participate in research projects. Apparently, some overtures were made at national meetings and elsewhere to invite collaboration, but there were few outside researchers involved directly with PCS staff at the conclusion of the Project's funded activity. This failure to attract outside research interest at any reasonable level, including doctoral candidates within the University, was most unfortunate.

Had there been any joint efforts developed, the Project would have benefitted in a number of ways, not the least of which would have been by gainning new perspectives on what could be done. The pessimism which prevailed in this project about the extent to which formidable research projects were possible in the New York City schools may still have resulted, but had other researchers with their own network of local relationships been recruited or co-opted, this conclusion would have been less likely.

If studies in Project schools might have disturbed the orderly development of rapport between Project staff and school personnel, why were other schools not contacted? Research which would benefit the City school system probably would not have been rejected by everyone,* particularly when one considers the potential help available from members of the Advisory Committee. These opportunities may not have been easily available, but they were worth pursuing.

4) Research or evaluation projects which included a broad staff consisting of coordinators, clinical staff, and school personnel

Partly as a result of the slow movement in the research area during the first three years of the Project, there was little time to conceive and execute a major study which employed the energy of a number of the Project's participating elements. It is not likely that all participants would have agreed to such a collaborative effort, but if planning for research had begun earlier, such an effort might have been possible. It could have been used to draw the staff together, combining their disparate interests, and serving as a mechanism that would have allowed them to jointly define purpose, while serving a similar purpose with participating school personnel.

Had any of these options been chosen early in the Project, there would have been a chance that the research and evaluation component might have had a favorable impact on the Project's operation. It would also have contributed immeasurably to the credibility of the Project in the science education community, and helped to strengthen the network of relation-

*One visitor to the Project from the City school system noted that the discussion of research intent was too muddled to receive support, but strongly disagreed with the view of PCS staff that a clear research effort would not have had school support.

ships with the school system. Its prospects for having increased the confidence and sharpening the ability of the Project's own professional staff should be obvious.

Such speculation does not imply that the research the Project conducted was useless, nor that the research staff was inept. What was done was done capably, and with care and attention. Several students and staff will use this research as their doctoral thesis material and some of it may be extended by persons who have begun their research careers. Thus, at certain levels it will have use. For the Project, for science education, for the New York City schools, and for the junior high school students involved in Project City Science, the research will not be very useful.

The research and evaluation component fell victim to underfunding, underplanning, and underemphasis. Other Project activities were deemed to be more important, and the early attention to elements needed for a substantial research and evaluation effort was simply not a major item on the Project's agenda. The lofty research goals and ambitions of the Project, often repeated in Project literature, were not realized, even though a small cadre of City Science staff worked very hard. Had their efforts centered on achievable goals which were decided upon early in the Project, and had adequate resources been allocated to this component, the final results might have been more favorable.

In brief, measured by the yardstick of its own initial ambitions, the research program of the Project has not been a success. It has fallen far short of all its early hopes and expectations. Even a quick reading

of the proposal, or of Progress Report #8 will quickly demonstrate the great distance between what the staff has accomplished and what had been proposed. The gap is truly noteworthy.

The Project staff showed too little familiarity with the research objectives. Few were seriously pursued. Outside assistance or consultation was not intensively cultivated, and the Research Institute was gradually made conditional upon added funding. Other factors consumed staff time. The Project was indeed confronted with difficult and inescapable circumstances that militated against success. Whether the eventual output was consistent with what the situation would allow is difficult to determine. The inescapable conclusion, however, is that the research component did not achieve its intended purpose, and that the actual outcomes were meager.

Recommendations

G. Depending on the emphasis that research plays in an overall project effort, several options exist regarding the strengthening of the research enterprise.

1) The PCS Advisory Board should be used more extensively by the research staff.

The advisory committee could have periodically reviewed the progress made and suggested revisions, extensions, or new leads for the research and evaluation component. This would have given the research personnel a direction which, to a great degree, was not attained until the conclusion of the fourth year of the project. A greatly expanded and more active role is suggested for this group.

2) A broader coalition of those with related interests in research should be sought.

The research expertise of other educational programs such as educational sociology, educational psychology, and the resident bureaus, such as the Office of Institutional Research, could have been more intimately involved in the planning of research and evaluation projects. The sense of the effort conducted is that the small cadre of professionals in the Project who were seriously pursuing ideas felt somewhat alone in their pursuit of relevant research and evaluation efforts which could have measurably contributed to the Project's success. It is urged that greater efforts be made to interest outside groups and to demonstrate the opportunities that PCS might present to them.

3) Other outside professionals could have been fruitfully used.

At a relatively small cost to the project, knowledgeable persons in science education research could have consulted with Project personnel on a regular basis. That remains possible. The staff must demonstrate the skill to attract sufficient interest in its efforts. Some of that can be accomplished through the conduct of research that draws attention to the unique opportunities such a Project provides. Other interest can be attracted through dissemination efforts.

This Project did not lack researchable areas. It suffered primarily from not being able to translate these topics into research and evaluation designs. Some of this may have been caused by concern as to what would be acceptable to the school personnel with whom they wished to collaborate.

Perhaps an early presentation of ideas to district personnel would have paved the way to an earlier start-up time for the research and evaluation efforts.

4) Some attention could have been paid to examining the relevance of evaluation and research to the on-going development of the Project.

Yearly assessments might have avoided the situation in which the Project finally found itself, that is, conducting research primarily related to educational psychology within the confines of a science education project. The fact that the studies and analysis do not neatly fit into "science education" does not make them without merit. Their efforts may ultimately be a contribution to the overall attempt to understand variables which affect the learning of junior high school students. The studies, however, have not maximally informed the Project about how well they are doing, nor how they could improve their efforts.

Few of the studies completed can be viewed as having provided information to the Project staff regarding the success of their teaching, curriculum development, administration, recruitment, placement, and community liaison activities.

The Project did focus its research efforts when considering how they might continue and extend the research and evaluation component. Two major proposals were prepared which were more centrally concerned with the ostensible content of this Project. Unfortunately, they did not yield the additional support which the staff was hopeful of obtaining. The Research Institute, which had become completely dependent upon the success of such efforts, was left with little or no prospect of being formed.

5) The planning for the funding, staffing, and activities of the Research Institute should have proceeded concurrently with all other Project activities.

It is acknowledged here that the outside evaluators and the PCS staff differ in interpreting this goal of the Project. The City Science staff felt that this Institute was intended to be in place at the conclusion of the five year funding period,* and that the research and evaluation activities conducted within the five year period, including proposals for additional support, were natural preconditions for the eventual establishment of this Institute.

The latter conception has some validity. However, if this Institute was as important as it appeared to be in the original proposals, it should have received far more attention than it did during the five year term of the Project. Linkages with local, state, and national projects, coordination with other research efforts at NYU, establishment of a research advisory or consultative body--all would have given some impetus and structure to this Institute.

Perhaps the original conception of an Institute was much too extensive for what could be accomplished in this Project. Based on Project documents, it was conceived to be an autonomous center ultimately separated from the Project, supported independently, and evolving from five years of experience

*The evaluators perceive this as a minimal condition. There was nothing to prevent its' earlier creation and the failure to develop the Institute seems a product of continuous postponement.

in research and evaluation of science education. It now seems evident even to the Project staff that such a goal was extremely optimistic. An Institute with capabilities for dissemination of knowledge and conduct of basic research with a national scope has not been developed. Of perhaps equal significance, planning for the Project's Phase III continuation does not appear to include a serious effort in the area of research and evaluation.

FOOTNOTES

1. National Science Foundation, RFP # 77-131, request for an evaluation of Project City Science, pp. 1-2.

2. Buccino, Alphonse, "Recommendations on the Future of Systems Experiments," NSF position paper, Sept. 1974, pp. 3-6.

3. New York University, Department of Science Education, Project City Science (Funded by the National Science Foundation), Quarterly Report #4, p. 31.

4. New York University, Department of Science Education, Project City Science; Revised Proposal; submitted to The National Science Foundation, January, 1976, p. 2. This proposal was a modification of the second proposal and will be referred to as the Revised Proposal.

5. "Science for Urban Junior Highs," Mosaic. vol. 5. #6, Oct - Sept., 1977, p. 33.

6. New York University, Revised Proposal, op. cit., p.3.

7. Ibid.

8. Ibid., p. 1.

9. New York University, Department of Science Education, The Continuation of Project City Science: A Cooperative Multi-functional approach to the Improvement of Intermediate School Science Teaching in the Inner City, proposal submitted to the National Science Foundation seeking refunding for Phase II (1976-79) of Project City Science, December, 1975, p. i. This proposal is referred to in the text and subsequent footnotes as the second proposal.

10. Ibid. , p. 7.

11. Ibid.

12. Ibid.

13. Ibid. , p. 8.

14. Mosaic, op. cit., pp. 31,33.

15. New York University, Revised Proposal, op. cit., p. 1.

16. Ibid., p. 1-2.

17. Ibid., p. 2.

18. New York University, Second Proposal, op. cit., pp. 9-10.

19. New York University, Project City Science, Progress Report 11, p. 41.

20. New York University, Department of Science Education, New York University Preservice Program for Intermediate School Science Teaching, compentancy based teacher education document mandated by the New York State Department of Education, submitted January, 1977, p.8.

21. Mosaic, op. cit., p. 31.

22. New York University, Revised Proposal, op. cit., p.3.

23. Sayers, Barbara, "Changing Science Instruction: Project City Science", NSTA News-Bulletin, May 1978, p. 9.

24. New York University, Revised proposal, op. cit., p. 4.

25. New York University, Project City Science, Progress Report 4, p. 11.

26. Weingartner, Charles and Postman, Neil, Teaching As A Subversive Activity, Delacorte Press, New York, 1969, p.33.

27. House, Ernest, The Politics of Educational Innovations, McCutchen Publishing Corporation, 1974, Berkly California, p. 176.

28. New York University, Revised Proposal, op. cit., p. 3.

29. Ibid.

30. New York University, Project City Science Quarterly Report 8, pp.68-71.

31. Ibid., p. 75.

32. Ibid., pp. 2-3.

33. Project City Science, Outline for the Integrated Science Course.

34. New York University, Project City Science, Quarterly Report 8, p.75.

35. Appendix D of Final Report, "Interviews of Project City Science Pre-Service Interns", p. 205.

36. New York University, Project City Science, Progess Report 8, pp. 90-92.

37. Sarason, Seymour, The Culture of the School and the Problem of Change, Allyn and Bacon, Boston, 1971, p. 213.

38. Appendix H of Final Report, "Assessment of Project City Science Pre-Service Training Model", p. 275.

39. New York University, Second Proposal, p. i.

40. Ibid., pp 44-49.

41. Appendix A, First Queens College Evaluation Report (1977-78) and Appendix B, Second Queens College Evaluation Report (1978-1979).

42. Progess Report 14, (June 1, 1978 to August 31, 1978) and Progess Report 15, (September 1, 1978 to December 31, 1978).

43. Progess Report 15, pp. 23-24.

44. Ibid., pp. 1-2.

45. Ibid., p.2.

46. Appendix B, Second Queens College Evaluation Report (1978-1979), pp. 56-58. Eastern Regional Educational Research Association.

47. See Appendix Q, Results of Data Collection, "Survey of High School Science Chairpersons," Spring 1979.

48. Rogers, Everett Diffusion of Innovations, The Free Press, New York, 1962. Five adoption stages include: awareness, interest, evaluation, trial stage, and adoption.

49. Quoted from independent observer report of National Science Teachers Association (NSTA) meeting at Atlanta, Ga., April, 1979.

50. A Foundation Goes to School: Comprehensive School Improvement Program, Ford Foundation, 1960-1970, New York, 1972.

51. Brickell, Henry Organizing New York State for Educational Change, State Education Department, Albany, New York, 1961.

52. Sarason, Seymour Culture of the School and the Problem of Change, Allyn and Bacon, Boston, 1971.

53. "Federal Programs Supporting Educational Change: Factors Affecting Change Agents" U.S. Office of Education Department of HEW, 1976 Volumes I-V, Santa Monica, California.

54. "Federal Programs Supporting Educational Change:, Rand Study, HEW, 1976, Volume II.

55. Colloquim on Planned Change in the New York City Public Schools, held at New York University, May 1, 1979, School of Education, Health, Nursing and Arts Professions.

56. Appendix of Final Report, "Summary of Results of Telephone Interviews of Colleges and Universities", p. 332.

57. Op. cit.

58. New York University, Revised Proposal, p.4.

59. Ibid., pp. 4,8,9.

60. New York University, Project City Science, Progess Report 8, pp. 24-31.

61. New York University, Revised Proposal, pp.4-5.